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Skeptical Inquirer

THE MAGAZINE FOR SCIENCE AND REASON

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ISSUES IN SCIENCE AND SKEPTICISM

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Lawrence M. KRAUSS
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Committee for Skeptical Inquiry
"... promotes scientific inquiry, critical investigation, and the use of reason in examining controversial and extraordinary claims."

[FROM THE EDITOR

Issues in Science and Skepticism

To mark our fortieth anniversary, we invited distinguished scientists, scholars, and investigators associated with the Skeptical Inquirer and Committee for Skeptical Inquiry to give us their thoughts. In contrast to earlier anniversaries emphasizing our founding leaders, this time we gave priority to scientists and skeptics who have come to prominence in the skeptical world in more or less the last twenty years. We had such a resounding response that we have decided to do two anniversary issues: in this first one we present a series of insightful essays on Issues in Science and Skepticism; in the next we will present personal Odysseys in Scientific Skepticism.

In this brief space, we can't begin to summarize all the issues and provocative ideas you will find in these pages. They vary widely. Here are just a few. Bill Nye calls for putting science and reason to work against science deniers and biblical literalists and preventing an impending climate catastrophe. We used to be a nation of innovators, he notes; with regard to climate we may have stalled, but our old get-it-done determination can be reinvigorated. Neil deGrasse Tyson describes what science is and isn't. Not fooling yourself is the crucial starting point. Another lesson: the objective truths that science eventually establishes—after much to and fro—exist outside your own personal perception of reality. "They are true whether or not you believe in them." Lawrence M. Krauss warns of the dangers of ignorant demagoguery and calls for more open questioning in all aspects of public and private life.

Steven Novella offers a wide-ranging review of what skepticism is, what we skeptics do, and why. It is a thoughtful reevaluation and self-examination that reminds us of our mission, our priorities, and certain recurring issues we all struggle with: matters of political opinion, religious claims, activism, and how different people decide what to tackle and what to ignore. Within skepticism, there is no one answer. We all treasure science and reason, but we are otherwise a diverse lot. Richard Wiseman tells why he is optimistic about the future of skepticism. Hint: It involves some of the same things, seen more positively, that worry other skeptics.

In case you fear that all this may be too self-congratulatory, Scott O. Lilienfeld and Sharon Hill quickly puncture that balloon. Lilienfeld thinks skepticism can do better. He offers a report card that, as he says, gives "ample reason for soul-searching." He worries about the extent to which our aims conflict, the effectiveness (or lack thereof) of our debunking efforts, and the need to consider research on cognitive development in spreading scientific thinking skills to the broader public. Sharon Hill offers nothing less than a powerful critique of the skeptical movement's style and effectiveness. She knows how important a strong skeptical presence is to counter the nonsense out there (that's what she does), but she says skepticism needs a total reboot.

And that's just the beginning. Philosopher Daniel Dennett considers the tricky question of authority in skepticism; science is based on evidence, not authority, but he decries postmodern relativism and "hyper-egalitarians" who eschew rational judgments. And, along with fellow essayists Daniel J. Helfand and Krauss, he worries about the effect of the Internet in making everyone think they are experts whether or not they follow the self-correcting precepts of scientific thinking.

And so it goes. Plunge into this intellectual, real-world thought-fest. Drink deeply. Think well.

—Kendrick Frazier

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THE MAGAZINE FOR SCIENCE AND REASON

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Eleven prominent leaders in scientific skepticism celebrate the 40th anniversary of the Skeptical Inquirer and the Committee for Skeptical Inquiry with a series of personal essays probing important issues in science and skepticism.

110 Nobel Laureate Scientists Urge Greenpeace to Drop Its Anti-GMO Stance

One of the biggest gaps between science and public perception concerns genetically modified (GM) foods. Scientists are near unanimous that GM foods are safe and furthermore necessary to feed the world's growing population. However, some liberal groups, such as Greenpeace, have ardently opposed them.

Now more than a hundred Nobel laureate scientists have signed a letter urging Greenpeace to change its opposition to GM foods. The letter—signed by 110 Nobel laureates in medicine, chemistry, physics, and economics—was reported June 30 by *Washington Post* science writer Joel Achenbach. It said studies have consistently found that GM foods are just as safe to eat as conventional foods and argued that Greenpeace was on the wrong side of this issue:

> We urge Greenpeace and its supporters to re-examine the experience of farmers and consumers worldwide with crops and foods improved through biotechnology, recognize the findings of authoritative scientific bodies and regulatory agencies, and abandon their campaign against "GMOs" in general and Golden Rice in particular.
>
> Scientific and regulatory agencies around the world have repeatedly and consistently found crops and foods improved through biotechnology to be as safe as, if not safer than, those derived from any other method of production. There has never been a single confirmed case of a negative health outcome for humans or animals from their consumption. Their environmental impacts have been shown repeatedly to be less damaging to the environment, and a boon to global biodiversity.

Golden rice is a genetically engineered strand of rice that helps reduce vitamin-A deficiencies, a serious problem causing blindness and death among children in the developing part of the world. The World Health Organization (WHO) has estimated 250 million people suffer from the deficiency, including 40 percent of the children in the developing world.

The letter said studies have consistently found that GM foods are just as safe to eat as conventional foods and argued that Greenpeace was on the wrong side of this issue.

WHO has stated that the scientific consensus is that gene editing in a laboratory is not more hazardous than traditional modifications through breeding. It has also called attention to a report of the U.S. National Academy of Sciences issued in May that said there is not substantiated evidence that GM foods have sickened people or harmed the environment.

The Nobel laureate letter campaign was organized by Richard Roberts, chief scientific officer of New England Biolabs, and Phillip Sharp, recipient of the 1993 Nobel Prize in physiology of medicine. The campaign's website is at supportprecisionagriculture.org.

"We're scientists. We understand the logic of science," Roberts told the *Washington Post*. "It's easy to see what Greenpeace is doing is damaging and is anti-science. Greenpeace initially, and then some of their allies, deliberately went out of their way to scare people. It was a way for them to raise money for their cause."

Roberts said he endorses many other activities of Greenpeace and said he hopes the group, after reading the letter, would "admit that this is an issue that they got wrong and focus on the stuff that they do well."

Greenpeace's initial reaction to the Nobel laureates' appeal was not encouraging. It said accusations that anyone is blocking genetically engineered Golden Rice "are false" and that the claims about it are "over-hyped."

CSI's Balles Prize in Critical Thinking Awarded to Julia Belluz of Vox.com

Paul Fidalgo

Vox
TOPICS
Julia Belluz
Senior health correspondent, evidence enthusiast
My mother always said, "Common sense is not so common." Trying to bring science and sense to news about medicine, food, and public health around the world. Follow me on Twitter @juliaoftoronto and my bio here: http://juliabelluz.com/
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Let's face it. Baseless alternative medicine and the people who profit from it have had it too easy. From time immemorial, the quickest way to appeal to a person's heart and reach into their purse has been to scare them with dubious warnings about their health and then sell them on some supposedly safe and, of course, "natural" remedy. In the Internet Age, it's even easier. Social media encourage knee-jerk responses that spur us to spread information that sounds just true enough, just hopeful enough, to convince us that it must be so. Baseless claims can be shrouded in scientific-sounding jargon, endorsed by seemingly reputable professionals, testified to by "real" people, and, of course, garnished with the time-honored phrase, "new studies show. . . ."

But a precious few dogged and determined journalists and activists have sought to use these same tools against the peddlers of pseudoscience to beat them at their own game. Yes, they have the science and the facts on their side, but now they also have the power of digital storytelling tools, social media, and, most important, the ability to communicate clearly and accessibly to a general audience without talking down to them. There aren't many who are engaged in this kind of crucial work, but among them one has truly stood out.

No one in this medium has shown the passion, the resolve, and the clarity displayed this year by Julia Belluz. At the news site Vox.com, Belluz covers medicine and public health, where she does more than report the news. She shines a disinfecting spotlight on the preposterous claims of gurus, conspiracy theorists, and peddlers of health myths and fads. She has consistently stood on the journalistic front lines, demolishing the paranoid claims of the anti-vaccine movement, exposing the absurd and often dangerous promises of things such as homeopathy, naturopathy, and fad diets, and perhaps most enjoyably, taking the outlandish claims of health-prophets such as Dr. Oz, the Food Babe, and Gwyneth Paltrow and cutting them utterly down to size.

Seriously, no one had Dr. Oz's number like Julia Belluz. It was really something.

But even in this ruthless pursuit of truth and facts over lies and superstition, Belluz's journalism is also eminently readable, entirely accessible to the general reader. She never comes across as pedantic or superior but as an ally, an advocate for reality, someone who has your back when the hucksters come fishing for your money.

We need more people in the media doing what Julia Belluz does. We need more journalists who are driven by a sincere desire to keep the public from being bamboozled about the most valuable thing each of us possesses: our health. For exemplifying this idea, Julia Belluz will be awarded the Committee for Skeptical Inquiry's 2015 Balles Prize in Critical Thinking. And we can't wait to see what she goes after next.

The Robert P. Balles Annual Prize in Critical Thinking is a $2,500 award given by the Committee for Skeptical Inquiry to the creator of the published work that best exemplifies healthy skepticism, logical analysis, or empirical science. The prize was established by Robert P. Balles, a practicing Christian, along with the Robert P. Balles Endowed Memorial Fund, a permanent endowment fund for the benefit of CSI.

Previous winners of the Balles Prize have included the writers and producers of *Cosmos: A Spacetime Odyssey*, Paul Offit for his book *Do You Believe in Magic?*, Michael Specter for his book *Denialism*, and Natalie Angier for her book *The Canon: A Whirligig Tour of the Beautiful Basics of Science*.

Paul Fidalgo is communications director for the Committee for Skeptical Inquiry.

9/11 Conspiracy Crowdfunding Project Rises—and Falls

Benjamin Radford

In May, a man named Paul Salo launched a crowdfunding project he claimed would prove once and for all whether the conspiracy theories about the September 11, 2001, terrorist attacks are true or not.

On his Indiegogo campaign (http://tinyurl.com/gtdmhbn), Salo wrote:

> Many people want to know more about 9-11. We are like a Mythbusters for September 11th. It's an important project for many reasons. Many people doubt various details of 9-11. As the world has changed our trust in government and media has declined significantly. We want to see for ourselves. We don't need people to guide our thinking. In this project we will recreate 9-11 to the best of our ability given the funds raised. Our ultimate goal is a fully loaded 767 and a similar structure to the WTC. We will crash the fully loaded (with fuel) plane (complete with black box) into the building using autopilot at 500 MPH.

Salo aimed to test the widely challenged (in conspiracy circles anyway) claim that jet fuel can burn hot enough to sufficiently weaken a building's steel structure that it collapses—instead of, for example, the Twin Towers coming down due to hidden explosives. Some people believe the project to be in bad taste, while others see it as a legitimate grassroots effort to get at a truth long covered up by the government.

Conspiracy theorists thrive on what is known as anomaly hunting: looking for any evidence that doesn't fit the "official story." So, for example, if in the initial confusion after a mass shooting one or two police officers or eyewitnesses on the scene report details that turn out not to be true (perhaps through a misunderstanding—mistaking a car backfire for a gunshot, for example), this provides grist for the conspiracy mill, evidence (or "evidence") that a cover up is in effect.

The idea of replicating a controversial event or project to test its validity sounds simple in theory; while Salo's scheme to duplicate the Twin Towers attack has a simple and populist appeal, actually pulling it off as a valid scientific experiment would be incredibly difficult and expensive, if not impossible. For a real science experiment, you need to control for variables that could affect the results; in this case, there are many variables, including size and weight of the plane, the building type, and so on.

He wouldn't be comparing apples to apples—or even apples to oranges—but apples to astronauts.

Salo wrote that "You will be able to see for yourself what happens under these extreme circumstances. I'm not sure which country we will purchase the aircraft and building but it doesn't really matter much." Actually, Salo will find when talking to engineers that it matters greatly where the building is, since building codes vary widely by country and region. Buildings in earthquake-prone regions are built differently (and able to sustain greater structural damage without collapsing) than those built elsewhere. Variations in construction materials would also complicate comparisons.

Salo has another problem: each building's architecture is different and will not necessarily react the same way to the same structural damage. In order for the experiment to be valid, he would need to build an exact replica of the Twin Towers; not just any tall building will do, since the load-bearing structures vary from building to building.

Despite his enthusiasm, Salo, like the public generally, greatly underestimates the rigor needed to conduct a valid scientific experiment. He says he plans to "recreate as best as we can" the circumstances of the World Trade Center attacks. The problem is that "as best as we can" will leave an enormous margin of error, one so big as to make any results invalid and pointless. His results would be dramatic and sensational but would hold no evidentiary value at all. He wouldn't be comparing apples to apples—or even apples to oranges—but apples to astronauts.

Furthermore, the experiment will be inconclusive no matter its outcome. Despite Salo's claim that "we will prove 9-11 to be true or false once and for all," the fact is that if the building collapses exactly as happened on September 11, conspiracy theorists will argue, correctly, that the conditions weren't exactly the same as in the original building collapse. If the building collapses differently, that won't prove anything either, and for the same reason. Neither those questioning or defending the "official story" will accept his conclusions and admit they were wrong. Salo asked for $1.5 million but raised less than $1,000 before the campaign was shut down.

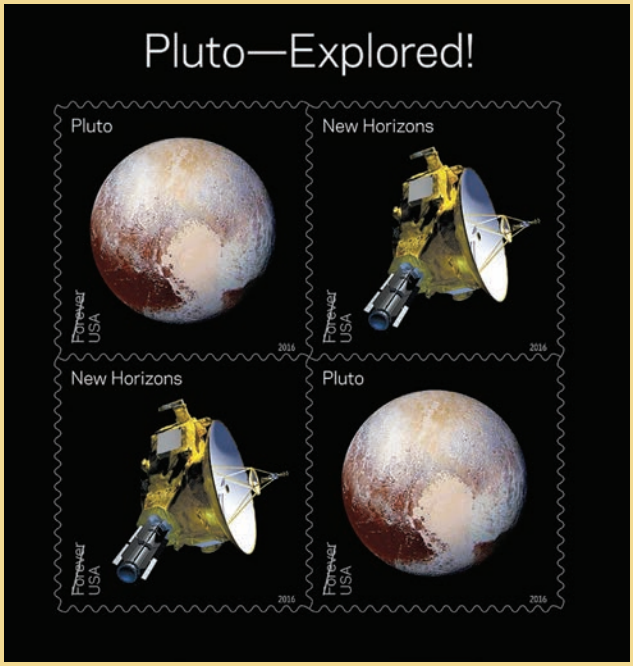
Benjamin Radford is the deputy editor of the Skeptical Inquirer.

Pluto and Planets on 2016 U.S. Stamps

Kendrick Frazier

Discoveries about the planets and our most famous dwarf planet, Pluto, are highlighted in a series of new U.S. commemorative postage stamps.

In May, the U.S. Postal Service issued "Pluto-Explored!" a four-stamp souvenir pane of two different stamps, one showing an artist's view of the NASA New Horizons spacecraft and one showing the enhanced color image of Pluto taken by the spacecraft near its closest approach to Pluto in July 2015.

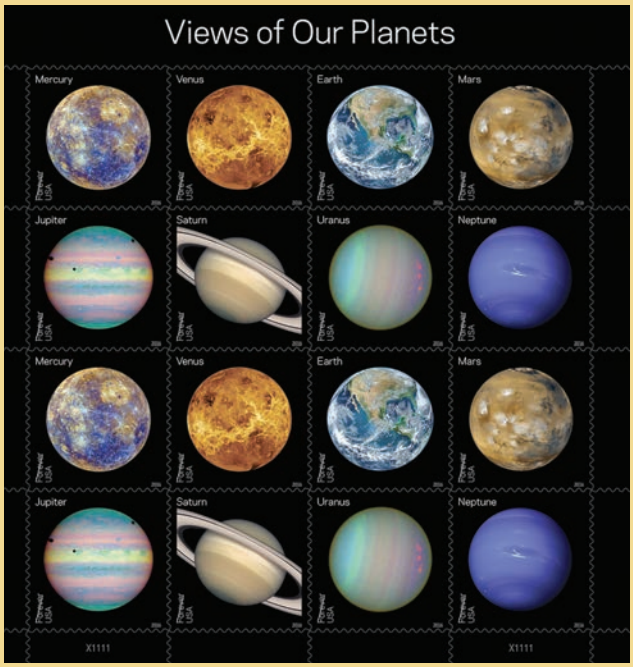


Discoveries about the planets and our most famous dwarf planet, Pluto, are highlighted in a series of new U.S. commemorative postage stamps.

It is an update of a stamp the Postal Service issued in 1991 titled "Pluto: Not Yet Explored." One of those 29-cent 1991 stamps was aboard the New Horizons spacecraft as it sped past Pluto in 2015. The image on the new stamp is a composite of images from New Horizons that clearly shows the heart-shaped feature across Pluto's surface that has been named Tombaugh Regio in honor of Pluto's discoverer, Clyde Tombaugh.

"The New Horizons project is proud to have such an important honor from the U.S. Postal service," said Alan Stern, New Horizon principal investigator from the Southwest Research Institute in Boulder, Colorado. "It is a wonderful feeling to see these new stamps join others commemorating first explorations of the planets."

The Postal Service also issued a pane of sixteen Forever stamps, "Views of the Planets," showcasing some of the more visually compelling, historic, full-disk images of the planets obtained during the past half century of space exploration. Eight new stamps, each shown twice, feature Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Some are in true color; some use colors to visualize certain features; others are in the near-infrared spectrum to show things the human eye cannot see.



The Postal Service is also issuing in 2016 a Global Forever stamp ($1.20) dedicated to Earth's moon, as well as a four-stamp tribute to fifty years of *Star Trek*.

Kendrick Frazier is editor of the Skeptical Inquirer.

Veteran Bigfoot Chronicler John Green Dead at Eighty-Nine

Matthew Crowley

Longtime Bigfoot chronicler, advocate, and field researcher John Green has died. Green was so renowned within the Bigfoot subculture that he was elevated to a vaunted "Four Horseman" status, along with Peter Byrne, René Dahinden, and Grover Krantz—the latter two also deceased. His book *On the Track of the Sasquatch* was a seminal work; though not the first book on the subject, it was popular, and many of the arguments in support of the reality of Bigfoot were cemented there. The book, published in 1968, included an analysis of the centerpiece of Bigfoot advocacy, the 1967 Patterson-Gimlin film. Green later wrote two similarly short books, *Year of the Sasquatch* and *The Sasquatch File*. A much longer work, *Sasquatch, the Apes Among Us*, was published in 1978.

As well as an author, Green could claim credit as a legitimate Bigfoot field researcher, having participated in the Pacific Northwest Expedition following track finds in Northern California in the late 1950s. That expedition proved fruitless and was noted for fractious personal infighting among the participants.

Given that decades of searching for Bigfoot have yet to produce a definitive somatic sample in the form of a carcass, bones, or even hairs, Green and others were forced to argue the merits of other types of evidence. Green's books were largely composed of anecdotes (some of which pushed the limits of credulity, in the sense that they could not be written off as cases of witness mistaken identity). Green strongly advocated that the Patterson-Gimlin film depicted a real animal. Here we see the genesis of memes within Bigfootery that continue to this day, one of which being that the film subject has arms impossibly long for a costumed actor to emulate. Indeed, Green doubled down on this claim, writing in a 2004 introductory preface to *On the Track* that "paradoxically, this silly attempt to prove that Patterson hoaxed his film led to the discovery that the movie itself has always contained proof that it does not show a man in a suit."

Green can be credited with creating, or at least popularizing, a meme within Bigfootery that lasts to this day, namely that Bigfoot is an animal instead of a paranormal entity.

Not surprisingly, this strong claim was rebutted by various skeptics, including me. The film subject is walking with a bent-kneed, "compliant" gait, which lowers the point where the hand swings across the thigh. As I and others have demonstrated, it's possible to bend the hand of an oversized glove to create an effective illusion of "bending fingers" at the end of one's arm. Ultimately, Green's "proof" was nowhere near as strong as he asserted.

Green can be credited with creating, or at least popularizing, a meme within Bigfootery that lasts to this day, namely that Bigfoot is an animal instead of a paranormal entity. Writing in *Apes Among Us*, he notes, "It is my opinion that trying to use one unexplained phenomenon to explain another one is not at all helpful," a position aligned with his stated mission of moving Bigfoot toward scientific credibility.

During a Bigfoot expedition in Western Washington in 2000, a very large plaster cast was made that was asserted to represent where a Sasquatch had sat down in muddy ground. This came to be known as the "Skookum Cast." Green examined the cast and found it strong evidence of Sasquatch.

Sadly for Sasquatch advocacy, the enthusiasm for the Skookum Cast proved to be short lived. Dr. Anton Wroblewski demonstrated with photographic comparisons—definitively and unambiguously—that the impression represented a reclining elk. It proved to be a giant embarrassment for Bigfoot research, as many of the preeminent advocates had echoed Green's opinion, some going so far as to claim the cast exhibited "dermal ridges" and "testicular impressions." Sadly, Green did not live to see the fruit of his quest in the form of an actual Bigfoot body, living or dead.

Matthew Crowley is a longtime Bigfoot researcher.

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Skepticism at the Center: NECSS 2016

Russ Dobler

Manhattan's Fashion Institute of Technology (FIT) isn't the first place you'd expect to find a skeptics conference. Deep in the heart of Chelsea, attendees of the eighth annual Northeast Conference on Science and Skepticism (NECSS, pronounced "nexus") had to brave their way past infamously anti-GMO restaurant chain Chipotle; an organic, grass-fed burger joint; and an empty building boasting $5 psychic readings before arriving at the meeting.

But FIT and NECSS have made strangely great partners over the past four years, since the conference cosponsored by the New York City Skeptics and the New England Skeptical Society, home to the Novella clan of *Skeptics Guide to the Universe* (SGU) fame, outgrew its former digs. Between 400 and 500 people converge here every spring. Travelers from thirty states and ten different countries arrived for the weekend fittingly starting on Friday the thirteenth of May 2016.

"A big part of NECSS is not just science, it's also art," said Brian Wecht, a comedian and musician who also happens to be a theoretical physicist. Wecht and the SGU's Jay Novella led a workshop the day before the official start of NECSS called "Improv for the Skeptically Minded" that encouraged using the comedy style's techniques of building on what's given to you and never shutting a person down to continue conversations with people who disagree with us. "That's something we, as skeptics, I think need to learn how to do better," Wecht said.

NECSS attendees helped craft the weekend's keynote presentation, too, as psychologist and science communicator Richard Wiseman brought his *Experimental* live show to the United States. Following a humorous talk that featured fan-favorite skeptical topics such as pareidolia and hearing unintentional messages in song lyrics, Wiseman left the stage and let the big screen direct the crowd through a series of decisions, culminating in a high-energy show and the exchange of crepe paper roses between strangers.

The pros were also out to entertain, with Baba Brinkman performing his critically acclaimed *Rap Guide to Religion* following the conclusion of NECSS on Sunday. The ubiquitous George Hrab couldn't be contained by a single night, presenting *The Broad Street Score*, a retrospective of his career arranged for string quartet, on Thursday night and then joining SGU Rogues and repeat NECSS guest Bill Nye "The Science Guy" for the hybrid comedic/musical revue *A Skeptical Extravaganza of Special Significance* on Friday.

Manhattan's Fashion Institute of Technology isn't the first place you'd expect to find a skeptics conference.

After ripping his shirt open to act out a scene from *The Shawshank Redemption*, Nye got back to serious science on Saturday. Both Nye and climatologist Michael Mann expressed "cautious optimism" that the world might have finally turned the corner on global warming denialism, en route to actually doing something about the problem. Linguist John McWhorter was on hand Sunday to explain why languages are simplifying and disappearing, and Jennifer Lopez of the Center for the Advancement of Science in Space clued the crowd in on what's happening at the International Space Station.

Lopez also moderated a panel on diversity in space exploration, but the real fireworks were expected to occur when Wecht led a discussion with McWhorter, neuroscientist Heather Berlin, Will Creeley of the Foundation of Individual Rights in Education, Julia Galef of the podcast *Rationally Speaking*, and "The SciBabe" Yvette d'Entremont. Titled "Free Speech, Social Justice, and Political Correctness," the talk was a response of sorts to the controversy created when the NECSS executive committee withdrew their speaking invitation to evolutionary biologist Richard Dawkins after he retweeted a video that many found offensive, only to invite him again shortly before Dawkins suffered a stroke. The panel more or less found common ground, though, when Creeley opined that unless they're completely unreasonable, we should seek out and talk to the people we disagree with most.

"In my case, that would be that guy," NECSS emcee Jamy Ian Swiss said of science journalist John Horgan. Horgan, perhaps best known for his 1996 book *The End of Science*, used his spot as the final speaker of the weekend to ask skeptics to stop picking on "soft targets," such as homeopathy and Bigfoot, and to focus their attention on bigger issues, such as untestable theories of physics and the nature of war.

Swiss countered Horgan's old argument by saying it's not that skeptics aren't interested in those things, but we are uniquely qualified to deal with all that other nonsense. In fact, it's why the skeptics' movement was founded—to tackle the issues people think important but that mainstream science considers too ridiculous to bother with. Homeopathy may be a "soft target," but it's something that takes millions of dollars from people while giving nothing back. Maybe when homeopathy belief comes down to under 10 percent of the population, we can give it a rest, Swiss said. Until then, there's still work to be done.

Russ Dobler is a geophysicist, journalist, and member of the New York City Skeptics.

[INVESTIGATIVE FILES JOE NICKELL

Joe Nickell, PhD, is a historical, paranormal, and forensic sleuth. His many books include *Unsolved History*, *Adventures in Paranormal Investigation*, and *Crime Science*.

Ley Lines: Investigating on Site

Mystical forces are as plentiful and diverse as the imaginations that create them. They include crystal healing, hauntings, and pyramid power—along with countless others. Among them are "earth energies"—supposed mysterious powers often associated with megaliths and other sacred or magical places—and (the focus of this study) the "ley lines" or "leys" that supposedly connect the sites.

What Are Ley Lines?

Originally, ley lines were supposed to be ancient—even prehistoric—paths that connected sacred places. The term was coined by Alfred Watkins (1855–1935), an English brewer's representative turned photographer and amateur antiquarian. Others had discovered alignments of ancient sites, but in 1921—while looking at a map of the Herefordshire countryside—Watkins noted that several ancient sites seemed aligned on an imaginary straight course that also crossed over some prominent hilltops.

He immediately intuited that such alignments were part of a Neolithic system of straight lines. He presented his ideas in two books, first sketched out in *Early British Trackways* (1922) and then developed in *The Old Straight Track* (1925). He argued that the alignments were devised so that Neolithic people could walk more easily from place to place, navigating by line of sight. He adopted the word *ley*—from lea, leigh, ley, etc.—meaning an enclosed field (Watkins 1925, 158), although there were no pastures in Neolithic times. While it is reasonable that some alignments might well have occurred as Watkins thought, it is also true that the vast number of ancient features—both natural and man-made—meant that many appropriate alignments would be expected to occur by chance.

Michell adopted Watkins's "ley lines" and linked them with Chinese *feng shui* ("wind-water").

No doubt far overstating the case, Watkins still never lapsed into mystical nonsense, as began to happen in the 1960s and 1970s with the rise of the New Age movement. In 1958 Aimé Michel, in his *Flying Saucers and the Straight Line Mystery*, postulated that sightings of UFOs tended to form alignments, and an early alien abductee claimed that extraterrestrials used lines of magnetic force to power their spacecraft. UFO believer Tony Wedd combined these two saucer concepts with Watkins's ley lines (Sullivan 2000, 2). Others were drawn to leys, and in 1969 paranormalist John Michell conceived of leys as invisible lines of an unknown natural "energy."

A "lifelong marijuana smoker," Michell (1933–2009) promoted all manner of pseudoscientific and pseudohistorical claims, including UFOs, crop circles, and other Fortean and New Age concepts. In his *The View Over Atlantis* (1969), he began to develop ideas that led to the "Earth mysteries" movement ("John Michell" 2016). He adopted Watkins's "ley lines" and linked them with Chinese *feng shui* ("wind-water"), which advocates the seeking of harmony with Earth's universal life principle, called *chi*. Chi is an imagined "energy" that supposedly flows through Earth and everything upon it and is affected by contours and changes of the landscape (Michell 1969, 46–54).

Michell regarded dowsing (the use of divining rods or pendulums) and clairsentience (psychic sensing) as

means of locating and verifying leys as "indeed lines of the earth current" (1969, 195). He wrote:

> The dowser's rod twitches as he crosses the spot where once an old stone marked the corner of a subterranean rift. The sensitive person feels the magnetic surge within the stone ring [e.g., Stonehenge]. For such places still bear the invisible marks of some feat of natural magic, performed by the adepts of the former world, space and time travellers, masters of revelation, to whom the earth was but another living creature, responding like a man to certain shapes, sounds and poetic correspondences, the keys to universal enlightenment. (Michell 1969, 192–193)

Michell not only held that there was a network of mystical lines of energy covering Britain but also, implicitly, such a network across the surface of the Earth. These ley lines linked prehistoric "sacred centres" as well as more recent holy sites and, it would soon be apparent, mysterious formations such as crop circles (Michell 1990).

Crop Circles

I first seriously encountered true believers in ley lines when I examined crop circles in southern English fields (guided by skeptics Chris Nash and John Eastmond) in June 1994. In the picturesque Wiltshire countryside, I came upon such ancient sites—all linked to ley line claims—as Silbury Hill (the tallest Neolithic man-made mound in Europe, see Figure 1), West Kennet Long Barrow (one of Britain's largest Neolithic chambered tombs), and Avebury (Europe's largest Neolithic henge monument, much larger than Stonehenge).

In our "field research," we examined two of the handful of crop circles and pictograms we discovered. The second of these had a crescent-and-circle design and was introduced to visitors by a crude sign placed by the angry farmer: "The Circle—it's a Hoax." Nevertheless, a group of local dowsers who preceded us there pronounced the pictogram genuine. One of them, applying his wand, claimed its reaction proved the formation was not a hoax but was formed by earth spirits (Figure 2). He observed that the design was on a ley line that linked nearby sites—running from West Kennet Long Barrow through Silbury Hill and on to another ancient site. He also helpfully took dowsing measurements of Chris's and my invisible "auras." At his request we meditated a few moments, whereupon the sweeping rods supposedly indicated our energy fields had expanded from a few inches to several feet (Nickell 2001, 70–82). (Elsewhere, I have reported on my investigation that found auras to be nonexistent [Nickell 2001, 142–149].)

Unfortunately, many of the leading cereologists—such as Terrence Meaden, Pat Delgado, and Richard Andrews—were dowsers or those who depended on dowsing by others to supposedly authenticate crop circles, often with their association with ley lines. Yet time and again, the circle designs were discovered to have been hoaxed (Schnabel 1994, 51–55, 100, 164–169, 152–169, 152–277). I helped analyze crop circle data that pointed to hoaxing as the most likely explanation for the phenomenon: the designs were more prominent in southern England, had proliferated in the wake of media reports, were increasing in complexity each season, and exhibited a "shyness" effect (i.e., the mechanism was never seen in operation). Subsequently, two retired artists, Doug Bower and Dave Chorley, admitted they had begun making the circles and then were imitated by others (Nickell 2001, 70–82).

Time and again, the circle designs were discovered to have been hoaxed.

'Druids Grove'

An investigative tour I made of Germany in the fall of 2002 included three sites in northern Bavaria associated with the legendary Celtic priesthood, the Druids. This expedition (which included the intrepid Martin Mahner and several members of the Bamberg Skeptics Guild) was led by geologist Michael

Figure 1. John Eastmond (left), Chris Nash, and Joe Nickell (taking photo) examine a crop-circle pictogram in Wiltshire, with Silbury Hill in the background.

Figure 2. A dowser claims his rod's reaction proves a crop pictogram is not a hoax but the genuine work of earth spirits. (Photo by Joe Nickell.)

Science has intervened to discredit all of the Celtic claims made for the site. There are no potsherds, skeletal remains, or other evidence of human habitation.

Link of the Paleontological Institute of the University of Erlangen. The area, some fifty kilometers southeast of Bamberg, is known as "Franconian Switzerland" due to its mountains and caves, castle ruins, and other scenic features. It was once inhabited by the Celts, a tribe that extended into central Europe in about 1200 BCE.

The first of the three sites was a remote wooded hill called Ringwall ("circular rampart"). Added to the natural limestone outcroppings were earthworks (now covered with moss and trees), creating what had actually been an ancient Celtic fortress. This identification was confirmed by excavations that revealed iron implements and pottery dating to circa 500 BCE. The second site (only about a kilometer and a half away) was a limestone cavern named Espershöhle. (It brought back memories of my avid spelunking adventures in the 1960s.) A passageway led to a fifteen-meter-deep pit where excavated artifacts and skeletal remains had proved it to be another Celtic site (Link 2002).

In contrast to these two scientifically validated sites is a pseudoscientifically claimed one known as Druidenhain or "Druid's Grove," which we also visited. Arrangements of giant rocks litter the wooded area, interspersed with passageways so as to create a labyrinthine effect and inspiring popular belief that it is an ancient Celtic site—indeed, as some have called it, the "University of the Druids." The megaliths—supposedly formed by the Celts by heating and cooling to produce fracturing—have been given such imaginative names as "Christening Stone," "Bowl Stone," and "Entrance to the Underworld." One is named "Sacrificial Stone," after an idea (dating from 1863), that the place was used for human offerings to deities.

Eventually, the site attracted dowsers who, in 1983, for example, concluded that the "Altar Stone" marked the intersection of two powerful "earth-ray" lines—that is, leys. In addition to identifying and tracking supposed ley lines at Druidenhain, dowsers have also employed their witching wands and pendulums to determine the supposedly true nature of a certain megalith they therefore call "The Grave" (Link 2002).

However, science has intervened to discredit all of the Celtic claims made for the site. There are no potsherds, skeletal remains, or other evidence of human habitation, nor any evidence that the site is Celtic or even man-made. To the contrary, the array of monoliths is actually *a natural formation*—the product of geologic forces and erosion. (During formation of the mountain, pressure fractured the rock, producing numerous cracks crisscrossing each other. These were then attacked preferentially by seeping water, the erosion eventually resulting in a multitude of rocks aligned in rows. [Link 2002].) Thus, Druidenhain is revealed as yet another folly of dowsers and ley-line seekers.

Nazca Lines

Heralded as "the example which really caught the public imagination" about leys (Heselton 1999, 59) and as representing "real physical evidence for the old straight track" in South America (Sullivan 2000, 10) are the mysterious Nasca lines in Peru. They consist of myriad lines and swaths that run ruler-straight for miles, together with great trapezoids and giant stylized birds and other figures that can be properly viewed only from the air. They were made by the pre-Incan Nazca culture that flourished in the area from 2000 BCE to about 600 CE. Their graves and settlement ruins lie nearby. In 2006, I was able to visit the area I had long studied from afar and to fly over what looked like a giant drawing board (Nickell 2007b, 151–158).

Because the figures are so large they can be properly viewed only from the air, they have prompted crank notions of "ancient astronauts" as hyped in *Chariots of the Gods?* by Erich von Däniken in 1970. These have been soundly discredited. Also the popular idea that the lines have astronomical purpose has been questioned, notably by Nazca expert Anthony F. Aveni and his team of archaeologists and surveyors. Instead, in over ten years of on-the-ground study, Aveni (distinguished archaeo-

astronomer and friend) discovered that the straight lines converge at "ray centers," which are positioned on hilltops or mounds. He suggests these lines and those of the figures were used as mystical walking paths—"labyrinths"—during irrigation rituals (Aveni 2000, 144, 212–222).

Having myself constructed two full-size replicas of the Nazca geoglyphs—the giant condor and spider (the latter for National Geographic Television's *Is It Real?*)—I took a new look at the labyrinth possibility. The figures' lines not only look like paths (formed by being cleared of the dark desert gravel and often have decidedly *winding* elements), but each is drawn with a continuous line and typically has an extraneous pair of lines that serve as entrance and exit. I am therefore convinced that the figures were indeed ceremonial paths (Nickell 2007a, 151–158; 2007b).

New Agers, beginning with John Michell (1969, 26), have rushed to include the Nazca figures and effigies on their long lists of ley lines–related sites. However, Nazca is atypical to say the least, and the ley folk's rules of inclusion are so variable as to belie use of the word *rule* at all. Whatever the Nazcas thought about the lines they so remarkably made, these offer no proof of the existence of an earth energy that is detectable by psychic methods such as dowsing.

Assessment

As these examples show, the "discovering" of ley lines is largely the province of persons predisposed to believe in mythical forces and often armed with dowsing devices. Books on leys invariably have sections touting dowsing (e.g., Michell's *The View Over Atlantis*, 1969; Heselton's *Ley Lines: A Beginner's Guide*, 1999; Danny Sullivan's *Leys*, 2000; and David Cowan and Chris Arnold's *Ley Lines and Earth Energies*, 2003).

Dowsing—including that used in so-called psychic archaeology (Nickell 2007a, 48–58)—has not been validated by science. Dowsing is simply "the unwitting translation of thoughts into muscular action"—the same force (the ideomotor effect) responsible for various other phenomena such as table tipping, automatic writing, and the movement of a Ouija board's planchette (Gardner 1957, 109; Randi 1995, 169–170). Dowsers have fared poorly in properly controlled tests of their abilities, as has been repeatedly demonstrated by psychic investigator James Randi (1982, 307–325; 1991, 31–50). I have also had similar results in testing dowsers (Nickell 1988, 89–102).

The more points that are "identified," the more lines may be drawn to connect them.

As to ley lines, there are several additional problems. Almost anything could serve as a point to connect not only megalithic sites but castles and churches, a tree or clump of trees, fiords, rock outcrops of peculiar shape, wells, ponds, boundary stones, and so on and on (Watkins 1925). Moreover, "almost *any* structure or random location . . . can be shown to lie at the intersection of at least a pair of ley lines" (Randi 1995, 189), and given sufficient random potential points, chance will inevitably allow straight lines to connect some of them—a fact that even Watkins himself tacitly understood (1925, 134, 203), as did Michell (1969, 11–12). The more points that are "identified," the more lines may be drawn to connect them.

Additionally, most claimed lines are not actually straight in precise terms (Randi 1995, 189). And later ley seekers discovered that by drawing concentric circles centered on certain sites, still more points could be connected (Michell 1969, 20)!

Over my career, I have visited scores of ley line–associated sites around the world—including the Tower of London, Budapest's subterranean labyrinth at Castle Hill, Istanbul's Hagia Sophia, Marakech's Koutoubia Mosque, Ohio's Serpent Mound, and the temple ruins of Pachacamac in Lima, as well as numerous sites in Germany where similar alignments are known as *Heilige Linien* ("holy lines") and China, including the Great Wall, where they are anciently termed *lung-mei* ("dragon paths") (Sullivan 2000, 8, 16; Michell 1969, 25). I had a poet's impressions at these sites, which can—I attest—inspire all manner of thoughts and feelings.

However, susceptible persons may imagine the supposed "hidden energy" that they then may "locate" by dowsing at various "ancient sacred sites" (Sullivan 2000, 2)—or indeed almost anywhere—and let the animated wands lead them further into fantasy. It is really just a matter of connecting the dots. ■

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'UFO Disclosure' Happening Again This Year

A lot of UFO excitement has been stirred up this election year, mainly due to Hillary Clinton's statements that if elected, she will release all of the government's UFO-related documents (unless they compromise national security). Also, her campaign manager, John Podesta, is a well-known, active UFO proponent (see this column, May/June 2016) and has even filed a Freedom of Information request concerning an alleged UFO crash in Kecksburg, Pennsylvania, in 1965. That "mystery" was solved long ago: what was seen in Kecksburg (and many other towns) was in fact the well-documented Great Lakes Fireball of December 9, 1965 (http://www.debunker.com/Kecksburg.html). But don't try to tell that to Podesta or other UFO true believers; they won't listen.

The conspiracy believers doubled down on their belief that great UFO secrets lie buried somewhere in the government archives.

Steven Bassett is the executive director of the Paradigm Research Group (PRG) based in suburban Washington, DC. His organization regularly holds press conferences to tout its supposed "UFO evidence," such as that Citizens' Hearing on UFO Disclosure in 2013 (http://goo.gl/LHUCRW). Bassett is the only registered "alien disclosure" lobbyist in the United States. Interestingly, all other lobbyists in Washington seem to be laboring on behalf of groups that can be shown to exist.

Interviewed by the *Daily Express* at its offices in London, Bassett told them:

> [UFO disclosure] will be a reality this year and across the front pages of newspapers across the world. The most significant news story that has ever been broken. …We are going to get disclosure this year. I am not sure who will win the election, but I think Obama will be the disclosure president. He will be looking at a Nobel Prize for making an announcement like that. I am 85 percent sure Obama will make the announcement before he leaves office and within days your Prime Minister David Cameron will follow.

However, almost as soon as the *Express* piece came out on May 20, 2016, Bassett was backtracking on that confident prediction. He wrote on his website:

> Naturally PRG does not and cannot guarantee a Disclosure event this year. However, in repeated interviews PRG has tried to convey just how close is that outcome and what is driving the process . . . PRG never says ETs have met with world leaders. That has not been proven. PRG usually says it is possible and would not be surprising and add it would be a difficult post-Disclosure admission. (http://goo.gl/QdPoI3)

Only those of us with long memories will recall the same "UFO disclosure" excitement building during the election of 1976. Democratic candidate Jimmy Carter had previously reported sighting a UFO—Venus, I found upon investigation (see http://goo.gl/ZQphaz)—and he had casually promised to release all the UFO files if elected. (Carter apparently did not realize that the Air Force's Project Blue Book UFO files had been released on microfilm a short time earlier by President Ford.) When Carter won the election but didn't "disclose" anything about UFOs, the conspiracy believers doubled down on their belief that great UFO secrets lie buried somewhere in the government archives—perhaps buried too deeply for even the president to unearth!

In light of this, it is time for a stroll down memory lane to revisit a few earlier confident predictions of "UFO disclosure."

• "It is my analysis that the ending of the

official government's UFO cover-up began August 7, 1996. . . . We may expect further announcements related to UFOs and extraterrestrial life, after the November 5 election."—UFOlogist Dr. Richard Boylan

- "Before the year is out, the Government perhaps the President—is expected to make what are described as 'unsettling disclosures' about UFOs."—*U.S. News & World Report*, April 18, 1977
- "We predict that by 1975 the government will release definite proof that extraterrestrials are watching us."—Ralph and Judy Blum, in *Beyond Earth: Man's Contact with UFOs* (1974)
- "The time is getting near when the U.S. Air Force will have to end its longstanding tactic of concealment."—Nationally syndicated columnist Roscoe Drummond, 1974
- "FLYING SAUCERS—THE REAL STORY: U.S. BUILT FIRST ONE IN 1942. Jet-propelled disks can outfly other planes. . . . By choosing which [jet] nozzles to turn on or off and the angle of tilt, the pilot could make the saucer rise or descend vertically, hover, or fly straight ahead, or make sharp turns . . . a big advance in the science of flying. . . . No official announcements are being made yet, but about the only big secret left is 'who makes them.' Evidence points to Navy experiments."—*U.S. News & World Report*, April 7, 1950

Now there is a new player in the government UFO game. He is Chris Mellon, of whom UFO author Leslie Kean wrote in the *Huffington Post* on May 9, 2016:

> For the first time, he has agreed to speak publicly about his experiences within government as they relate to UFOs. . . . It is unusual for a man of Chris's stature to speak openly about UFOs, which gives his statements great weight. His positions during the Clinton and Bush administrations involved high clearances; in fact, there are few people who have enjoyed such deep and wide-ranging access to compartmented programs in both the Defense Department (DoD) and the intelligence community. (http://goo.gl/Tq0bS7)

Kean's interview establishes that Mellon has been a UFO believer since childhood:

> I was about seven years old when I saw an old-fashioned amateur movie taken by a friend of our school principal. It showed a huge, golden disc-shaped object serenely moving through sunny, blue skies, passing through cumulous clouds in a manner that would be very hard to fake. I have no idea what became of the movie, but it filled me with wonder and awe.

Move over, Roswell—there's another New Mexico town vying to be the UFO capital of the state.

A little investigation reveals that in 2002, when Mellon was Deputy Assistant Secretary of Defense for Intelligence, he was "interested in pursuing the use of paranormal phenomena for threat scenario development and potentially in a tip-off role for future terrorist actions" (http://goo.gl/RJFyO9).

Unfortunately for "UFO disclosure" advocates, what Mellon had to say to Kean on that subject was this:

> I highly doubt DoD or any other government agency is concealing UFO information. I participated in a comprehensive review of DoD's black programs and spent over a decade conducting oversight of the national foreign intelligence program, an almost totally separate world of secrets. I visited Area 51 and other military, intelligence and research facilities. During all those years, I never detected the faintest hint of government interest or involvement in UFOs.

* * *

Move over, Roswell—there's another New Mexico town vying to be the UFO capital of the state. Tiny Dulce, in northern New Mexico just south of the Colorado line, offers more extraordinary claims than Roswell: underground alien bases, lots of UFO sightings, mysterious black helicopters, cattle mutilations, even Bigfoot. Plus, the alleged Aztec flying saucer crash of 1948 is not too far away. In Dulce, the headquarters of the Jicarilla Apache Nation, you can now buy alien-themed T-shirts and even a "Sasquatch burger." Tribal council President Ty Vicenti urges visitors to "talk to the many tribal members who have firsthand contact with UFO sightings and stories" (http://goo.gl/VRsQrM).

A "Dulce Base UFO Conference" was held at the Wildhorse Casino and Hotel in Dulce May 14–15, 2016. UFO lecturers, including several Native Americans, regaled the audience with tales of grey aliens and such. A guided tour was offered of the rugged Archuleta Mesa, using four-wheel drive vehicles. Directly below there is where the military base with the grey aliens supposedly exists. According to conspiracy writer John Thomas Didymus, "The base, with multiple levels embedded deep underground, is the largest single Reptilian and Grey alien base in the world where alien technology reverse-engineering projects are ongoing" (see http://goo.gl/VzgvIR; he doesn't tell us where the smaller alien bases are located). So far as is known, nobody has ever located the entrance to this supposedly massive underground complex.

On March 28, 2009, the show *UFO Hunters* on the History Channel did an episode concerning the alleged Dulce base and about alleged human/animal hybrid experiments supposedly occurring there. Then the show was suddenly canceled, even though it had (reportedly) been enjoying good ratings. In an interview with the famed mystery-monger Whitley Strieber, Bill Birnes, the star of *UFO Hunters*, suggested that the series was canceled because the Dulce episode had "gone too far," and the big businesses sponsoring the History Channel wanted to keep the lid on what is allegedly occurring deep underground there (http://goo.gl/5hgw1m). ■

NOTES ON A STRANGE WORLD] MASSIMO POLIDORO

Massimo Polidoro is an investigator of the paranormal, lecturer, and cofounder and head of CICAP, the Italian skeptics group. His website is at www.massimopolidoro.com.

William Tell: Myth or Reality?

In medieval Switzerland, the ancient Austrian imperial house of Hapsburg dominated some regions, including the mountainous canton of Uri, which is rich in forests and glaciers. According to one story, a hunter—an honest family man and a skilled archer—lived there. His name was William Tell. On November 18, 1307, Tell traveled with his son Walter to the regional capital, Altdorf.

In the main square, the local representative of the Hapsburgs, bailiff Heinrich Gessler, had a pole on top of which he had placed his hat as a symbol of imperial authority. Anyone who did not bow down to the hat risked death or the confiscation of his property.

Tell, perhaps distracted or because of his mountaineer pride, ignored the hat as he entered the city. Immediately, he was arrested, and in the square, in front of everyone, he was compelled to justify his action. The only way to resolve the situation, Gessler stated, was if with his crossbow Tell was able to pierce an apple placed on top of the hunter's son's head. In that case, freedom would be given, otherwise they would both die.

William agreed. He perfectly hit the apple, but it turned out that under his robe he concealed a second arrow, one which he planned to use to kill the tyrant in case he accidentally hit his son. Tell ended up back in custody and was brought to the boat that would take him to prison in Gessler's castle in Küssnacht.

When they reached the lake, though, a storm broke and the jailers freed Tell, a skilled helmsman, in order for him to help them survive. Arriving on the other shore, Tell lept to the ground and with an energetic thrust pushed the boat away and escaped the police. He then hid behind a tree for three days along the Quarry Road that led from the

Gotthard Pass to Zurich. Finally, he saw Gessler approaching on horseback; Tell called to him and killed him with an arrow from his crossbow.

Upon hearing in January 1308 of Tell's exploits, the people rose: the three cantons of Uri, Schwyz, and Unterwalden settled an agreement and managed to forever expel the Austrian invaders from their land. Tell became a national hero, a universal symbol for freedom and independence.

The (Little) Historical Evidence

The story is compelling, and we understand how, even today, it is able to boost national pride among the Swiss. But the question that historians always ask is if this is a true account or just a legend. For centuries, scholars have scoured parish registers and medieval archives, from the Hapsburg's Austria up to the canton of Uri, looking for references to the name or story of William Tell. But the evidence, so far, has been very scarce.

The first written reference to William Tell appears in a manuscript dated 1470, the *White Book of Sarnen*, compiled by the provincial chancellor Hans Schriber. Another source of Tell's exploits is the "Song of the Founding of the Confederation." Composed in 1477 by an anonymous poet and published for the first time in 1545, it recounts the birth of the Swiss Confederation and quotes the adventures of Tell. Curiously, it says that Tell was drowned in Lake Lucerne by the evil Gessler.

But the most important work that presents for the first time the story of William Tell as a whole is undoubtedly the *Chronicon Helveticum* of 1550, the work of historian Aegidius Tschudi. In his account, Tschudi explains that Tell really drowned in 1354, not because he was killed by the bailiff but in order to save a child who fell into the river Schächen—a true hero to the end. The episode is also depicted in a fresco of 1582 kept in the chapel of Bürglen, the village Tell came from.

The *Chronicon* would become the model for all those who later wrote about William Tell, and it became the main source for the drama of 1804 *Wilhelm Tell*, written by Friedrich Schiller, in turn adapted as an opera in 1829 by Gioacchino Rossini for his *Guglielmo Tell*. These two works have greatly contributed to the renewed popularity of the Swiss hero.

Tell and the Nazi

Even Adolf Hitler tried to appropriate the figure of William Tell in order to justify his political objectives. He even mentioned him in *Mein Kampf* and declared enthusiastically that the Tell of Schiller not only gave a body to the National Socialist Party's ideas, but it also gave shape to the concept of the community of nations and to the figure of the ideal leader whom he believed himself to be. However, after a series of failed attacks on the Führer, including that of the Swiss Maurice Bavaud who was dubbed "the new William Tell," Hitler ordered in 1941 that the work of Schiller had to be stopped from being represented. At a banquet, he then exclaimed: "Why in hell Schiller had to immortalize a Swiss sniper!" His *Tell* ended up being the only German classic text hit by a ban for representation or reading under the Nazi regime.

The Places of William Tell

Even if he never existed, William Tell's traces are scattered all over Switzerland and, in particular, in the canton of Uri. In the village of Bürglen, you can see the spot where, according to tradition, the house of Tell stood, which is now a frescoed chapel with episodes from the hero's life. Also in Bürglen is based the Tell Museum, with hundreds of objects dedicated to him. In the square in Altdorf, where the apple challenge is said to have taken place, there is a monument that was dedicated in 1800 to Tell. Nearby, you can see the remains of Gesslerburg, the castle that the bailiff had in Küssnacht. On the Cava road, which leads from Küssnacht to the village of Immensee, there is a chapel that was erected to commemorate the place where Tell's ambush to Gessler took place. A third chapel of William Tell ultimately lies on the banks of Lake Lucerne, between Flüelen and Sisikon, just at the point where Tell was able to abandon the boat that was leading him to prison.

An Old Story

As noted, however, all references to William Tell appear only 150 years after the events and are mainly of a literary nature, if not explicitly fantastic. There are no contemporary documents showing that a man named William Tell really lived in the canton of Uri around 1300, a man who struck an apple on his son's head with an arrow, who then killed the Austrian bailiff, and finally led the fight for the independence of the cantons.

Some thought it was just a matter of spelling—perhaps his name was written differently. For example, researchers found a family named von Thal who lived in 1300, but the head of the family's name was Conrad, not William, and he had nothing to do with the hero.

In fact, the legend does not stand up to historical facts. The pact between the cantons did not take place in 1308 but in 1291, and the expulsion of the Austrians was not immediate but took many decades and into the fifteenth century. But above all, the history of the shooter forced to shoot an apple from his son's head was not new.

From beer to butter, passing restaurants and pharmacies, garages and television stations, the "brand" William Tell is omnipresent in the Confederacy.

The *Gesta Danorum* (*History of the Danes*), written in the twelfth century by Scandinavian monk Sexo Grammaticus, contained several stories, including that of the Danish prince who would later inspire Shakespeare for *Hamlet*. Among others, he told of Toko (or Palnatoke), a skilled hunter who boasted so much of his archery skills that a King Harald forced him to shoot an apple placed on his son's head. Toko had already decided that in case of failure a second arrow would kill the king, but he succeeds in the enterprise, and, perhaps because of it, he ends up imprisoned by the sovereign. Of course he escapes from the prison and kills the tyrant in an ambush. It is the exact story of William Tell.

An even older story, dating back to the eleventh century, is the Norwegian history of Eindridi, who was forced by King Olaf the Holy to hit a tablet of clay resting on his son's head with a dart. From the same era is the story of the hunter Hemingr, also a Norwegian, who agreed to fight in a series of sporting competitions with King Harald. Hemingr defeated the king, who was furious and ordered the hunter, if he wanted to save his life, to strike a nut placed on the head of his son. Hemingr does so and soon after, as with Tell and Toko, takes his revenge by killing the king.

A Ubiquitous Hero

The Swiss national hero, therefore, at this point seems more a myth than a man who actually lived—but a myth still alive and well today. "Too often, scholars have been content to say that William Tell did not exist and that therefore they were to throw it in the dustbin of history. And yet, looking at the world, I see it everywhere," says Uli Windisch (2015), professor of sociology at the University of Geneva.

From beer to butter, passing restaurants and pharmacies, garages and television stations, the "brand" William Tell is omnipresent in the Confederacy. "We live day after day with him," continues Windisch. "We can see him, feel him, touch him, wear him, fit him, drink him, eat him. There are many of us who dislike or worship him."

According to the sociologist, the success of Tell is mainly due to the fact that the story of his exploits is easy to interpret. And we must not forget that the myth evokes fundamental issues that affect everyone. "Freedom, courage, rebellion against a totalitarian power: we are all attached to these values," concludes Windisch. "Everyone can find a landmark. His image is universally known and, like it or not, it always evokes something." ■

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The Science Literacy Paradox

Why Really Smart People Are Often the Most Biased in Their Opinions

When presented with contradictory evidence about a politically contentious issue, it's easy to fall into the trap of reacting emotionally and negatively to that information rather than responding with an open mind. We may not only discount or dismiss such evidence, we are also likely to quickly call into question the credibility of the source. "Motivated reasoning," defined as the "systematic biasing of judgments in favor of one's immediately accessible beliefs and feelings," write political psychologists Milton Lodge and Charles Taber (2013), is "... built into the basic architecture of information processing mechanisms of the brain" (p. 24).

But here is the surprising paradox: studies show that in politically contentious science debates, it is the best educated and most scientifically literate who are the most prone to motivated reasoning. Researchers differ slightly in their explanations for this paradox, but studies suggest that strong partisans with higher science literacy and education levels tend to be more adept at recognizing and seeking out congenial arguments, are more attuned to what others like them think about the matter, are more likely to react to these cues in ideologically consistent ways, and tend to be more personally skilled at offering arguments to support and reinforce their preexisting positions (Haidt 2012; Kahan 2015).

The intensity and proficiency with which really smart people argue against challenging evidence explains why brokering agreement on issues such as climate change, natural gas fracking, nuclear energy, evolution, and other issues is so challenging. There is no obvious solution to this paradoxical bind, and there is no easy path around the barrier of our inconvenient minds. But in talking with others, we can adopt specific practices that may at least partially defuse the biased processing of information, opening up a space for dialogue and cooperation.

Liberals and conservatives who score low on science literacy tend to hold equivalent levels of support for science funding.

Our Knowledge-Based Differences

Over the past decade, researchers studying science-related controversies via public opinion surveys and experiments have documented numerous instances of smart people disagreeing in politically motivated ways. For example—contrary to overwhelming scientific consensus—studies find that better educated conservatives who score higher on measures of basic science literacy *are more likely* to doubt the human causes of climate change. Their beliefs about climate science conform to their sense of what others like them believe, the dismissive arguments of conservative political leaders and media sources, and their sense that actions to address climate change would mean more government regulation, which conservatives tend to oppose (Kahan 2015).

Lest you think that conservatives are uniquely biased against scientific evidence, other research shows that better educated liberals engage in similar biased processing of expert advice when forming opinions about natural gas fracking and nuclear energy. In this case, their opinions reflect what others like them believe, the alarming arguments of liberal political leaders and media sources, and their skepticism toward technologies identified with "Big Oil" and industry (Nisbet et al. 2015).

A similar relationship between science literacy and ideology has been observed regarding support for government funding of scientific research. Liberals and conservatives who score low on science literacy tend to hold equivalent levels of support for science funding. But as science literacy

increases, conservatives grow more opposed to funding while liberals grow more supportive, a shift in line with their differing beliefs about the role of government in society (Gauchat 2015).

The polarizing effects of knowledge have also been observed in relation to religiosity and beliefs about evolution. In this case, greater science literacy predicts doubts about evolution among the most religious but acceptance of evolution among the more secular (Kahan 2015). But isn't belief in evolution an indicator of science literacy? Rather than measuring scientific knowledge, studies show that questions about evolution tend to measure a commitment to a specific religious tradition or outlook. Many in the public are aware of the scientifically correct answer to questions about evolution, but if not otherwise prompted, by way of a process of motivated reasoning they are inclined to answer in terms of their religious views (Roos 2014).

The polarizing effects of knowledge have also been observed in relation to religiosity and beliefs about evolution.

For example, in 2012 when half of survey respondents were asked by the U.S. National Science Board to answer true or false, "Human beings, as we know them today, developed from earlier species of animals," 48 percent of those questioned answered "true." But among the other half of the survey sample, those who were asked "*According to the theory of evolution*, human beings, as we know them today, developed from earlier species of animals," 74 percent answered "true." A similar difference in response occurs when a true or false question about the big bang is prefaced with "*According to astronomers*, the universe began with a big explosion" (National Science Board 2014). (See also, SI, "Science Indicators 2014. . . ." May/June 2014.)

Because they are politically contested issues, asking people whether they believe in evolution, the existence of climate change, or the safety of nuclear energy is equivalent to asking people with which social group they identify. As a result, people's responses to these questions do not reflect what people know factually about the issue or how people interpret and integrate the knowledge that they hold. Instead, such questions reflect people's core political and religious identities. In sum, our beliefs about contentious science issues reflect who we are socially. The better educated we are, the more adept we are at recognizing the connection between a contested issue and our group identity (Kahan 2015).

A Different Kind of Conversation

To overcome motivated reasoning on topics such as climate change or evolution, some research suggests that we should look for opportunities to explicitly explain the uncertainty relative to scientific understanding and to be fully transparent in how scientific conclusions are reached and how uncertainty is reduced. From this view, it is a mistake to reply to challenges to scientific authority by arguing that the "science is settled." A scientist's credibility, write communication researchers Kathleen Hall Jamieson and Bruce Hardy (2014), depends on communicating that she is "faithful to a valuable way of knowing, dedicated to sharing what she knows within the methods available to her community, and committed to subjecting what she knows and how she knows it to scrutiny and hence, correction by her peers, journalists, and the public."

Political scientist James Druckman (2015) echoes similar recommendations for overcoming motivated reasoning. A key strategy is to communicate when possible about consensus evidence endorsed by a diversity of experts, make transparent how scientific results were derived, and avoid conflating scientific information with values that may vary among the public. In this case, he emphasizes the importance of "values diversity," in which scientists avoid offering value-laden scientific information, defining for the public a "good" or "competent" decision or policy outcome. Rather than arguing on behalf of a specific outcome, experts should work to ensure relevant science is used or at least consulted in making a policy decision.

Research by Yale University's Dan Kahan (2010) and colleagues suggests that a possible effective strategy for overcoming biased information processing is to "present information in a manner that affirms rather than threatens people's values." People tend to doubt or reject expert information that could lead to restrictions on social activities that they value, but Kahan's research shows that if they are provided with information that upholds those values, they react more open-mindedly.

For example, conservatives tend to doubt expert advice about climate change because they see it as aligned with regulations and other actions that restrict commerce and industry. Yet Kahan's research shows that conservatives tend to look at the same evidence more favorably when they are made aware that "the possible responses to climate change include nuclear power and geo-engineering, enterprises that to them symbolize human resourcefulness."

Cultivating Reasoning Skills

In response to research demonstrating the polarizing effects of basic science literacy, decision scientists Caitlin Drummond and Baruch Fischhoff (2015) in a recent study focused instead on testing the role of more fundamental scientific reasoning skills. If individuals possessed the skills to think and reason like a scientist, could this trump the tendency for really smart people to rely on their political and social identities in forming

opinions about controversial subjects?

Drummond and Fischoff asked survey subjects eleven questions that measure the skills needed to demonstrate competence in evaluating scientific evidence or to "think like a scientist." These questions asked about double-blind experiments, causality, confounding variables, construct validity, control groups, ecological validity, history and maturation effects in surveys or experiments, measurement reliability, and response bias.

Respondents on average answered seven of these eleven questions correctly. Individuals who scored higher on the scientific reasoning scale were better educated, more open-minded, and tended to be older. Of particular interest, scientific reasoning ability was unrelated to either political ideology or religiosity. After controlling for several confounding factors, higher scores on the scientific reasoning scale consistently predicted acceptance of the scientific consensus on vaccines, genetically modified foods, and human evolution but not climate change or the big bang. In a skills test, individuals scoring higher on the scientific reasoning scale were also more likely to correctly interpret numerical information regarding the effectiveness and side effects of certain drugs. Based on these findings, scientific reasoning skills appear to be predictive of attitudes consistent with scientific consensus on highly contested issues (though not on climate change). The challenge is that such skills are not easily acquired once formal education ends, leaving few if any effective communication strategies for bolstering scientific reasoning among the adult population. Nevertheless, the research findings underscore the importance of teaching scientific reasoning skills as part of the high school and college-level curricula to as broad a segment of the student population as possible. At the college level, an easy first step would be to ensure that students take a greater number of rigorous science and social science courses as part of their general education requirements. ■

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Fate: Inventing Reasons for the Things That Happen

In April 2016, Houston, Texas, was struck by a massive flood that claimed seven lives. On his blog *End of the American Dream*, Michael Snyder noted that this was the "Eighth historic flood in this country since the end of September." While other writers pointed to global warming as a likely explanation for such extreme weather, Snyder saw a biblical sign:

> So why is this happening? Some believe that "climate change" is responsible for these bizarre weather patterns, others are pointing the finger at El Nino, and yet others believe that this is a sign that we are approaching "the last days" described in the Bible. What everybody should be able to agree on is that what we are witnessing is highly, highly unusual. (Snyder 2016)

As it turns out, Snyder is the author of several books about the coming rapture, so it is possible his interpretation was influenced by financial self-interest. But he is not the only person seeing religious meaning in the weather. During the Houston floods of May 2015, some conservative observers claimed that the city was being punished for rampant "witchcraft and sodomy," pointing out that Houston had a "sodomite mayor" (Haraldsson 2015).

In the happier world of falling in love, people often see the hand of fate at work. A Jewish single person is sometimes said to be searching for his or her *bashert*. The common meaning of this Yiddish word is soul mate, but its original meaning is "destiny or fate." On the other hand, "star-crossed" lovers—the most famous of all being Shakespeare's Romeo and Juliet—are astrologically doomed from the start. As deserving of happiness as the lovers may be, things are bound to go badly.

Humans appear to see fate in many places, and science is here to tell us why—or at least how.

In an interesting recent case of seeing destiny in love, Indiana couple Ashley Goodwin and Kyle Rebman met when Ashley was in the hospital and Kyle, a technician, took care of her. Eventually they fell in love and got engaged. Meanwhile, years earlier Kyle had been diagnosed with kidney disease, and by coincidence it was discovered that Ashley was a match. Without hesitation, she donated a kidney to her future husband, and both made a speedy recovery. They were to be married this past summer ("Couple Getting Married . . ." 2016). According to the report, Ashley believes that it was all meant to be. "What are the chances that he would just so happen to be working when I was sick and that's how our relationship bloomed, and I was the one to donate the kidney to him?"

The Science of Fate

You might guess there wouldn't be much psychological research on belief in fate, destiny, or purpose, but you'd be wrong. There is a surprisingly deep vein of studies on these topics in both children and adults. A recent poll found that 38 percent of Americans believe natural disasters are signs from God, but more abstract notions of fate, destiny, or purpose are also very common (cited in Banerjee and Bloom 2015). Humans appear to see fate in many places, and science is here to tell us why—or at least how.

Children Find a Lot of Reasons

Jean Piaget was the first developmental psychologist to propose that children see physical objects as designed for a purpose, and subsequent research has borne him out. Psychologist Deborah Kelemen of Boston University has argued that young children exhibit "promiscuous teleology" (a phrase only an academic could love), meaning they find goals and purposes in almost everything (Kelemen 1999). For example, although older children and adults understand that only living things have goals, young children are less exclusive. A seven- or eight-year-old might say that a mountain is shaped the way it is so that animals have something to climb on. Kelemen suggests that children start out with this promiscuous teleology as a kind of cognitive building block and that as they age, they learn to narrow the identification of goals and purposes to biological things.

In addition to finding purpose in the design of objects, children also see meaning in events. In a 2015 study, Konika Banerjee and Paul Bloom of Yale University tested children's preferences for natural and purposeful explanations for life events. They selected three groups of participants: young children five to seven years old, older children eight to ten years old, and adults. The participants were given a series of simple life events, such as "Briana's cat ran away." Figure 1 shows an example scenario.

For each of these life events, children were given the choice between only a natural explanation (e.g., "because she left the door open") and a natural and teleological explanation (e.g., "because she left the door open and to teach her responsibility"). Banerjee and Bloom found that the majority of younger children chose explanations that included an underlying intention, but the preference for intentional explanations decreased with age.

In a study such as this, you might imagine the children who chose the purposeful explanations all came from religious households, but Banerjee and Bloom found exposure to religion did not matter. There was no difference in the number of teleological explanations given by children from religious and nonreligious families. The same was true of the adults. Although adults had much lower levels of intentional explanations, their responses were not related to their level of religiosity.

Banerjee and Bloom concluded that children have a broad tendency to animate the world with purposeful explanations. They suggested that this tendency diminishes over time because children judge a broader set of events to be more "significant" than adults, who eventually come to find many of these things trivial; and with age, people become aware of the social norms that label these explanations superstitious.

Interestingly, Banerjee and Bloom take no stance on whether identifying a design or purpose necessarily requires thinking about a designer or a god. They point out that it is possible to infer the purpose of a functional object (e.g., a door knob) without thinking about a designer.

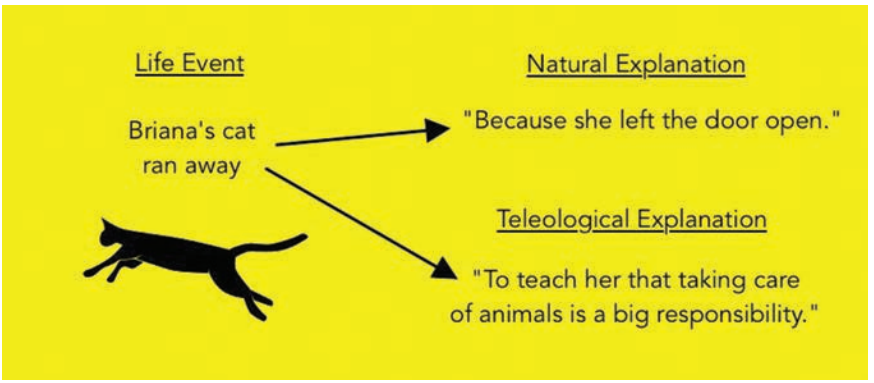
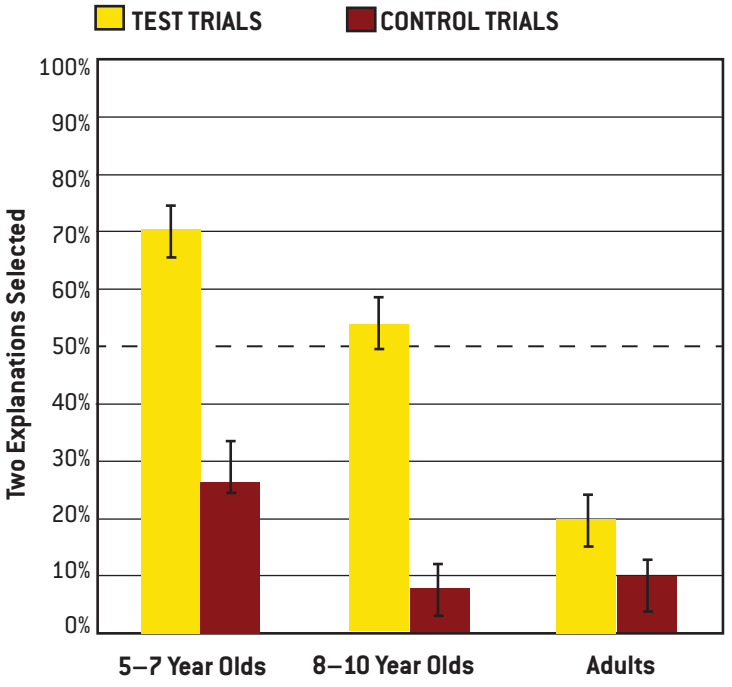

Life Event
Natural Explanation
Briana's cat ran away
"Because she left the door open."
Teleological Explanation
"To teach her that taking care of animals is a big responsibility."

Figure 1. Typical life event and explanations used by Banerjee and Bloom (2015).



A graph based on the results from Banerjee and Bloom (2015, Experiment 1). The descending yellow bars show that preference for purpose or goal-related explanations decreases with age. (The red bars were a control condition designed to determine whether young children simply had a preference for two explanations over one. The results suggest that it was the teleological nature of the answer that appealed to the children, not merely the number of explanations.)

Fate Doesn't Need a God

The situations used by Banerjee and Bloom were designed to appeal to children, and as a result they were not very good tests of adult beliefs about intention or fate. But several other studies show that when events are considered unusual or personally significant, adults also see meaning, fate, or intention. Furthermore, although religious people are more likely to see destiny in important events (i.e., the hand of God), many atheists also see intention in the world.

Our scientific understanding of the origins of the universe, of species, and of human behavior do not make room for fate or destiny.

For example, in a study of students who were either European Canadians or East Asian Canadians, Ara Norenzayan and Albert Lee asked participants to read scenarios of very unlikely events and then describe how much each event could be attributed to fate or destiny. Norenzayan and Lee examined two demographic factors, both of which affected people's judgments of fate: religion (Christian vs. nonreligious) and culture (European Canadian vs. Asian Canadian). As expected, Christians were more likely than nonreligious participants to point to fate as a cause, but Asian Canadians—regardless of whether they were religious or nonreligious—also were more likely to cite destiny as a cause (Norenzayan and Lee 2010).

The study by Norenzayan and Lee revealed two distinct forms people's notions of fate can take. The first is the traditional one: God, a deity who acts as an agent controlling events on Earth. The second was simply a belief that—without reference to an external agent—the universe is interconnected and aimed at certain outcomes. In fact, the cultural difference in the interconnectedness form of destiny—most often seen in Asian Canadians—was a more powerful factor than religion.

Norenzayan and Lee also showed how the interconnected universe concept could be induced by suggestion. In a separate experiment, European Canadians who were primed by reading a short essay about the "butterfly effect" later gave more fatalistic explanations for unlikely events.

In a 2014 study, Banerjee and Bloom made things even more real by asking participants to think about an actual important life event they had experienced. In this case, 53 percent of God-believing participants and 24 percent of nonbelievers attributed their personal event to fate. Even among people who were described as "ardent atheists," 21 percent saw some form of fate involved in their lives (Banerjee and Bloom 2014, Study 2).

In a similar investigation, Bethany Heywood and Jesse Bering found that—consistent with previous research—theists were more likely to explain difficult life experiences by reference to some external intention (e.g., "God's plan"). But fully half of the thirty-four atheists in the study also gave at least one answer that implied a purpose to the events (e.g., "it was meant to be"; Heywood and Bering 2014).

Why All This Fate?

So, children exhibit "promiscuous teleology," and even ardent atheists often see destiny in the things that happen. Despite the fact that—if I have not already made this point, perhaps now is the time to say—ideas of fate are supernatural or paranormal. Our scientific understanding of the origins of the universe, of species, and of human behavior do not make room for fate or destiny. These concepts would require some entity or designer standing apart from the natural world and yet controlling it. This is not a scientific idea, but it is one many people still believe—from a very young age.

Why?

This is where things get murky. Several researchers in this field hoped to get to the bottom of why this fatalistic view is so common, but their answers have been all rather speculative. Deborah Kelemen's observations of promiscuous teleology have led her to conclude that young children are "intuitive theists" who see design in the natural world—a characteristic that poses a challenge for science education, which should be aimed at creating a natural understanding of the world, free of designers and gods (Kelemen 2004). But Kelemen is careful not to speculate on whether children's tendency to see purpose in the world is due to nature or nurture.

In contrast, in his (very interesting and entertaining) book *The Belief Instinct*, evolutionary psychologist Jesse Bering (2012) argues that our tendency to see design is an "adaptive illusion" that stems from the uniquely human ability to create a "theory of mind," hypotheses about other people's thoughts and motives. So Bering comes down on the side of nature, suggesting that our intuitive theism is a built-in product of natural selection.

Teasing apart nature and nurture is always a difficult task. Even the five-year-old children in Banerjee and Bloom's studies have been in the world for five years, listening to adults yammering on, day in and day out. There must be some socializing effect of all that talk.

A recent cautionary tale shows just how careful we must be when making assumptions about nature vs. nurture. For years, psychology professors have been teaching their students about a classic 1977 study by Andrew Meltzoff and M. Keith Moore, which purported to show that newborn babies were ca-

pable of imitating facial expressions, a strong indication of an inherited ability (Meltzoff and Moore 1977).

Meltzoff and Moore's research always seemed a bit too good to be true, and now a new, more rigorous study in *Current Biology* shows the original results were probably wrong (Oostenbroek et al. 2016). A report on the new study in *Research Digest* puts it this way: "Based on their results, the researchers said that the idea of 'innate imitation modules'" and other such concepts founded on the ideal of neonatal imitation "should be modified or abandoned altogether" (Jarrett 2016).

Human behavior is always a mixture of nature and nurture, and determining the proportions of each is rarely easy. So when it comes to our tendency to see purpose, destiny, or fate in the universe, we must be cautious in our interpretations. The study of European and Asian Canadians, for example, suggests that culture affects the *type* of fate that people see in the world—God versus an interconnected universe—but as yet, we have less information about how culture and socialization affect our basic tendency to see fate. At the very least we can say that for whatever reason, many young children see a design in the objects and events in the world—a design that goes far beyond science. Whether our intuitive theism is a side effect of a built-in human adaptive advantage, as Bering suggests, or is learned through socialization, this tendency to see the hand of fate represents an important obstacle to achieving a clearer, more scientific understanding of the world. ■

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Dog Behavior: Beneath the Veneer of 'Man's Best Friend'

In Homer's eighth-century BCE *Odyssey*, Odysseus referred to the domestic dog as a "noble hound," and it may have been Frederick II, King of Prussia, who in 1789 first characterized *Canis lupus familiaris* as "man's best friend." Emily Dickenson famously judged that dogs are "better than human beings" because they "know but do not tell." Dogs are capable creatures, certainly, but are they as intelligent and considerate as most of humans apparently believe? Regardless of breed, can their levels of consciousness truly support qualities such as nobility, loyalty, and friendship?

Dogs are capable creatures, certainly, but are they as intelligent and considerate as most of humans apparently believe?

Ethologists, by contrast, attempt to assess animal behavior more objectively by emphasizing its biological foundations. Classic ethology was founded on the notion that animals are driven by *intrinsic motor-patterns*, or species-specific, stereotyped products of natural selection (Lorenz 1982). Modern practitioners, however, often introduce additional factors into the ethological equation. Many suggest, for example, that intrinsic motor-patterns can be *accommodated* to developmental and environmental influences. Some argue as well that complex and otherwise confusing behaviors can *emerge* from interactions between two or more simpler behavioral rules.

Evolving Motor-Patterns

Fellow ethologists, biologist Raymond Coppinger and cognitive scientist Mark Feinstein, argue that much, if not all, dog behavior can be explained by reference to these three ideas—without resorting to more romantic notions of consciousness or sentience, let alone loyalty and friendship (Coppinger and Feinstein 2015). In the crucial context of foraging, for instance, intrinsic motor-patterns manifest similarly in all canids.

As adults, canid predators display the following generalized foraging sequence: ORIENT → EYE (body still, gaze fixed, head lowered) → STALK (slowly forward, head lowered) → CHASE (full speed) → GRAB-BITE (disabling the prey) → KILL-BITE → DISSECT → CONSUME. But some species, and some individual dogs and wolves, might substitute one motor-pattern for another. Tending to hunt small prey, coyotes might occasionally swap the FOREFOOT-STAB pattern for the CHASE pattern, and HEAD-SHAKE for KILL-BITE. Big cats such as the puma, by contrast, might substitute FOREFOOT-SLAP for GRAB-BITE to bring larger prey down from behind.

The precise form of GRAB- or KILL-BITE can vary between species as well, often based on the predator's evolved anatomy. The puma usually kills with a bite to the neck, crushing its prey's trachea, or to the muzzle, suffocating the victim. But the wolf often GRAB-BITES the prey's hind legs, shredding its arteries and slowly bleeding it to death. Puma and wolf anatomies—jaw structure, dentition, and musculature, in particular—apply different mechanical forces and thus demand the evolution of at least slightly different foraging behaviors.

Domestic dogs, on the other hand, tend to be far less purposeful. Having long relied on humans for sustenance, they rarely demonstrate complete predatory foraging patterns. Instead, different breeds have retained programs for different partial sequences. Border collies, for instance, are famous

for obeying the EYE pattern. In fact, I once owned an Akita that employed FOREFOOT-STAB with astonishing expertise to capture mice foraging deep beneath the snow.

Nevertheless, say Coppinger and Feinstein, "certain commonalities have long persisted in the predatory motor-pattern sequences of all carnivores, reflecting their shared ancestry" and "an intrinsic 'wired-in' program of rules." Learning is neither necessary nor optional. Indeed, as soon as their foraging sequences are interrupted for whatever reasons, some wild-types are rendered incapable of continued pursuit. Pumas can't consume an animal that's already dead, for example, and, although wolves generally can enter their foraging sequences at any point, they often can't perform GRAB-BITE if interfered with following expression of the partial EYE → STALK → CHASE sequence.

Dogs have similar limitations. Coppinger and Feinstein recall two conversations with different sheep ranchers. The first shepherd commended his livestock-guarding dog for independently standing watch over a sick ewe for days without consuming it. The second, however, complained because his guarding dog ate a lamb that tore itself open on a barbed-wire fence. To the ethologists, these seemingly inconsistent behaviors were anything but. Livestock-guarding dogs generally do not express the DISSECT motor-pattern. In fact, their only foraging rule is CONSUME. The first dog wasn't a "good" dog, necessarily—it was just an unlucky dog. And the second animal wasn't really a "bad" dog—it simply performed its intrinsic program when afforded the opportunity to do so.

Accommodating Environment

That many motor-patterns are stereotyped and non-modifiable does not imply that dogs and other animals are mere automata driven solely by internal programs. Certain behaviors can arise as well from an *accommodation* of the intrinsic to the contingencies of external forces. Under the "right" circumstances, in other words, animals commonly act in species- or breed-specific manners.

But when exposed to other environmental conditions, their behaviors can look very different (Twitty 1966).

Indeed, if animals encounter such conditions during a developmentally "critical" or "sensitive" period—that is, a species-specific, time-bound stage of growth—they might never display certain typical behaviors. For example, many prospective service dogs flunk out merely because they can't negotiate stairs, curbs, or even sewer grates. Why not? According to Coppinger and Feinstein, their vision systems never fully developed because they were raised in kennels that were sterile and spacious but nevertheless lacking in three-dimensional structures.

Research also suggests that canids have critical periods for social bonding, during which exposure to a given stimulus will reduce the animal's fear of that stimulus in the future (Scott and Fuller 1998). Some argue further that certain conspicuous behavioral differences between canid species can be explained, at least in part, by distinct onsets and offsets of these periods (Lord 2013). For instance, the sensitive bonding period for dogs begins at about four weeks and ends at about eight weeks, while the same period begins and ends two weeks earlier for wolves.

Crucially, dogs and wolves develop their sensory abilities at about the same time—sight and hearing at six weeks, smell much earlier. As such, wolves have only their sense of smell to rely on during their sensitive bonding period. One general result is that more stimuli, including humans, will remain unfamiliar and thus frightening to them as adults. But dogs can suffer similar consequences when raised in the absence of direct human contact.

Research also suggests that canids have critical periods for social bonding, during which exposure to a given stimulus will reduce the animal's fear of that stimulus in the future.

With bonding periods in mind, Coppinger and Feinstein invite us to guess why the Maremma guarding dogs they studied in Italy would abandon their human shepherds to trail their flocks. Were they merely obeying their evolved, gene-based intrinsic motor-patterns—or perhaps their training? Did they actually understand the importance of their job? None of the above, say the authors: guarding dog behavior can be "explained by accommodation to

particular environmental factors during a critical period in the development of socialization."

During his famous, Nobel Prize–winning experiments in 1935, Konrad Lorenz was able to transfer the social allegiance of newly hatched greylag geese from their mothers to not only Lorenz himself, but to inanimate objects, including a water faucet. Coppinger and Feinstein produced similar effects with their Maremmas. When raised with sheep instead of humans, the dogs usually stuck with the sheep. Interestingly, however, a few Maremmas preferred to remain at home when both the sheep and their shepherds left for the fields. These dogs had actually bonded with milk cans that no doubt smelled very much like the sheep.

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Emerging Complexities

Yet other canine behaviors cannot be easily explained by reference to either intrinsic motor-patterns or their accommodations to environmental influences. Consider the collaborative hunting of large prey in wolves, for example. Here, individuals within the pack appear to work closely together according to a preconceived plan, synchronizing their movements and relative positions to prevent prey escape. At first glance, the spectacle tempts us to infer not only extraordinary intelligence but insight as well.

Coppinger and Feinstein, however, suggest an explanation relying not on naive anthropomorphisms but rather on our knowledge of canine behavior plus the intriguing concept of *emergence*. Nothing new under the intellectual sun, emergence proposes that complex and novel phenomena can arise from the accidental, "self-organizing" interaction of far simpler rules and processes.

Two classic examples illustrate the principle. Known for their towering, complicated, yet surprisingly well-ventilated structures, termite mounds obviously are not designed and erected by hyper-intelligent insects. Similarly, many species of migrating birds (Canada geese in particular) tend to fly in a conspicuous V-pattern, but not because individual geese possess advanced senses of aesthetics. The more likely explanation, say the authors, is that members of each species act only according to very simple rules. Termites transport sand grains to a central location. Perhaps their movements are sensitive to humidity levels and the relative concentration of gasses. Geese evolved to fly long distances and to draft behind others to lessen their burdens. The impressive results were never planned; they simply emerged from the interaction of much humbler, species-specific rules.

The practice of collaborative hunting among wolves is no different, according to Coppinger. He and his colleagues recently created a computational model including digital agents representing both pack and prey (Muro et al. 2011). When they imposed three basic rules on individual predators—move toward the prey, maintain a safe distance, and move away from other wolves—the model produced a successful pattern of prey capture appearing remarkably similar to the real thing. But in no way were Coppinger's results dependent on agent purpose, intelligence, or cooperation.

Consider dog "play" as well. One popular explanation of play generally is that it evolved as a "practice" motor-pattern to prepare animals for escape. But play only partially resembles any given adult motor-pattern sequence. And to be even minimally effective, escape has to be performed correctly the first time, which is precisely why motor-patterns are intrinsic, stereotyped, and automatic—as Coppinger and Feinstein observe, "no practice is ever required."

As any dog owner will attest, canine play is commonly manifested in the "play bow"—a posture in which the animal halts, lowers its head, raises its rear-end, and stretches its front legs forward. Many have interpreted the bow as a purposeful invitation to engage in play. But more careful observations and experiments suggest otherwise. Play bows often result when dogs and wolves enter into an EYE → STALK motor-pattern sequence only to be interrupted by their subjects' failures to react—that is, to run. As such, the bow might actually reveal a combination of two conflicting rules: stalk and retreat. If so, the posture itself is neither an adaptive motor-pattern nor a signal of intent. Rather, say Coppinger and Feinstein, "it is an emergent effect of a dog (or wolf) simultaneously displaying two motor-pattern components when it is in multiple or conflicting states." ■

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Playing to an Empty Room: Ghost Hunting and 'Singapore Theory'

Q: I saw ghost hunters using something called "Singapore Theory" to find ghosts. What are they referring to?

—D. Parsons

A: Rich Newman, author of several books on ghost hunting, including *The Ghost Hunter's Field Guide* and *Ghost Hunting for Beginners*, endorses "Singapore Theory," which assumes that

> playing music from a particular era (that, presumably, of when a spirit was actually alive) will instigate a response on the part of the ghost. . . . Since you do not know what particular era a spirit may be from, you will probably want to keep a folder of MP3s that range across time . . . [including] classical music, some Civil War-era songs, jazz from the turn of the century, blues, and more. . . . By re-creating the environment the spirit was once comfortable in while alive, you may get the responses you want and capture some evidence of the haunting. (Newman 2011, 90–91)

Ghost hunters have used some version of this for decades, for example hiring re-enactors to perform scenes a ghost might have experienced or using antique items that were common during the era in which a ghost they're trying to contact was alive (such as using Civil War–era items to try to contact Gettysburg spirits). When the technique is formally described—instead of simply put into practice—it may be known by various names including "familiarization theory," but when applied to music intended to provoke ghostly response, "Singapore Theory" is its common name.

At first glance, "Singapore Theory" seems vaguely plausible: if there's a spirit present, and if it can hear, and if you know what music he or she liked when alive, then one or more famously fickle ghosts might respond favorably to that music by making contact.

However, a closer examination of the circumstances of ghost hunting reveals that none of those conditions are present: Ghost hunters do not know—and *cannot* know—for certain that a ghost is present (if a scientifically valid way to detect the presence or absence of ghosts existed, then we'd have proof of spirits). More to the point, even if a ghost was suspected of being present, it would be virtually impossible for a ghost hunter to correctly identify a par-

ticular piece of music that a particular long-dead unknown person might have listened to, much less enjoyed or had some connection to, at some point anywhere from months to centuries earlier.

A bit of historical perspective helps inform the discussion. To take the United States as an example, hundreds of thousands of immigrants from Germany, Italy, France, Ireland, Spain, and elsewhere helped settle this country. Chinese laborers, for example, worked on railways and in laundry houses in the Old West; many of them spoke little or no English. Unless a ghost hunter happened to find a song that was popular around 1850 in Shanghai, for example, which a young man destined to die in the Old West might have learned to play on a *pipa* (fretted lute) or *yehu* (fiddle), the chance of musically connecting to this ghost are slim.

Just because a person lived during a certain era doesn't necessarily mean they listened to and enjoyed whatever music was popular in a specific area at that time.

What if the ghost you're trying to communicate with is Navajo or Hopi, and the only meaningful music are traditional tribal dances he or she grew up with? What if the ghost you're trying to communicate with was born in Russia in 1790 and never spoke a word of English and certainly never listened to any Civil War–era songs or jazz?

Just because a person lived during a certain era doesn't necessarily mean they listened to and enjoyed whatever music was popular in a specific area at that time. For example, though the jitterbug was especially popular in the 1930s and 1940s and Elvis Presley was popular from the 1950s onward, many people of the era didn't like—or listen to—that music at the time, and many people still listen to that music decades later. Mozart and Beethoven are world-famous but that doesn't mean their music was familiar at the time all over the world, from Indonesian fishing villages to Brazilian farms.

If you could somehow know (or determine with a high likelihood of accuracy) that a given location had been visited only by a few people who could possibly have died there—and you have thoroughly documented those people's backgrounds—then you might conceivably be able to select music that they might have listened to. For example, if a ghost hunter visited a remote cabin far out in the Nevada desert that was known to have housed only a single Gold Rush miner hermit, or a compound in Antarctica where only a few dozen people had lived, then you could have a chance at selecting music that people who once lived (and possibly died) there might have enjoyed. There is simply no way to accurately identify every single person who may have died in a particular place.

But in fact, most locations where ghosts are reported (historic hotels being a perfect example) are exactly the places where thousands, or tens of thousands, of travelers from all over the world have stayed at one time or another. Hubs of travel—such as airports, bus stations, train stations, and hotels—are exactly the locations where people of wildly varied cultures, languages, customs, and musical preferences are likely to have visited (and perhaps died) over decades and centuries. Assuming ghosts exist, realistically and statistically the chance of any given particular jazz or Big Band tune that a ghost hunter happens to have and chooses to play in a particular location being familiar to a particular ghost is vanishingly small.

Nor is there any established range for ghosts: Does a ghost haunt only the room where he or she died or a whole house or a whole neighborhood or a whole state? Sometimes ghosts have been reported not where they died but where they lived and worked—their businesses and saloons, for example. Depending on which arbitrary "ghost rules" a person assumes ghosts obey, any ghost might haunt any location.

Unless ghost hunters can somehow correctly identify the age, race, religion, gender, social class, nationality, and other personal information of a particular ghost, there is virtually no chance that whatever music they select to prompt the ghost would be relevant to them. The ghost you are trying to woo into conversation with what you imagine might possibly be familiar tunes to them might have died five months ago or five hundred years ago. He or she might have been raised on blues, jazz, classical, hard rock, rap, or music from other countries. It's even possible that the person never heard any music at all while alive, if for example he or she was born deaf or died shortly after birth.

Without knowing any of the correct biographical details of a ghost, it is virtually impossible to accurately predict what music they might have heard, much less enjoyed. Keep in mind that recorded popular music has existed only since about the 1930s. Thus as a practical matter it would be difficult for a ghost hunter to even obtain and play recorded music that anyone before that era would recognize.

Even if a ghost hunter could somehow correctly determine a ghost's favorite *type* of music, it would be of little help since in reality most people's musical tastes are far more specific. They might like rock and roll, for example, but that doesn't mean they like anything that might be included in that category, from Guns 'N' Roses to Air Supply; a person who likes country music might like Johnny Cash but not the Dixie Chicks, and so on. No music style is homogenous. Because not all jazz, bluegrass, or rock is the same, the likelihood that whatever MP3 music

files Rich Newman or another ghost hunter might have brought to play would just happen to be music that the dead spirit would recognize and respond to is remote at best.

Ghost hunters using "Singapore Theory" are instead forced to draw from pop culture stereotypes and tropes. They make (largely baseless) assumptions about what sort of stereotyped ghost they expect might haunt the location (a gunslinger, a slave, a soldier, etc.). As with most ghost hunting protocols, there's no logic, evidence, or science behind the method; it's based on little more than speculation and guesswork.

As with most ghost hunting protocols, there's no logic, evidence, or science behind the method; it's based on little more than speculation and guesswork.

To see just how absurd "Singapore Theory" is, imagine ghost hunters a century from now trying to use it to communicate with an American alive today: Without a clue about the age, race, gender, or culture of that hypothetical person, what music could they possibly choose that would be liked or familiar to him or her? Eazy-E? George Jones? Yanni? Taylor Swift? The Beatles? Aerosmith? Mozart? Youssou N'Dour? Ludakris? Shania Twain? Megadeth? Lady Gaga? Ricky Martin? Michael Jackson? Shakira? Vivaldi? Bob Marley? The Everly Brothers? Nirvana? Ragheb Alama? Frank Sinatra? Warren Zevon? B.B. King? Woody Guthrie? M.C. Hammer?

All these musicians—and thousands more around the world—created music that at one time or another, among people of a certain age and sociocultural demographic, was popular. But just because a person was alive at a time when a song was popular doesn't mean they ever even heard it. As a rule, Baby Boomers listened to different music than their parents did as well as than their children did. But that's not always the case: new generations are being exposed to music from many decades earlier, and thus some teenagers today are just as familiar with Miley Cyrus as the Beatles.

The fact that "Singapore Theory" and other such methods are taken seriously by many ghost hunters as a proven and credible technique should be concerning; if these experts, who write books and teach classes on investigation, don't recognize the absurdity of this ghost hunting technique, what does that say about their other advice and instruction? ■

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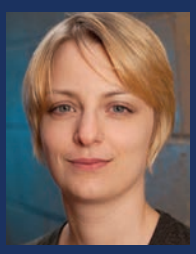
For in-depth interviews with the most fascinating minds in science, religion, and politics, join *Point of Inquiry* cohosts Lindsay Beyerstein and Josh Zepps at pointofinquiry.org.

Josh Zepps (cohost) is a new media pioneer; a journalist serving as a founding host and producer at the online talk network HuffPost Live, following hosting stints with such outlets as Bloomberg TV, the Discovery Channel, and as an anchor for CBS's Peabody Award-winning *Channel One News*.



Lindsay Beyerstein (cohost) is an award-winning investigative journalist and staff writer for *In These Times*. Her work has appeared in places such as *The New Republic, Reuters, Slate, Salon, Ms. Magazine*, and *The New York Press*. Wait to see what stories she tells with her guests on *Point of Inquiry*.

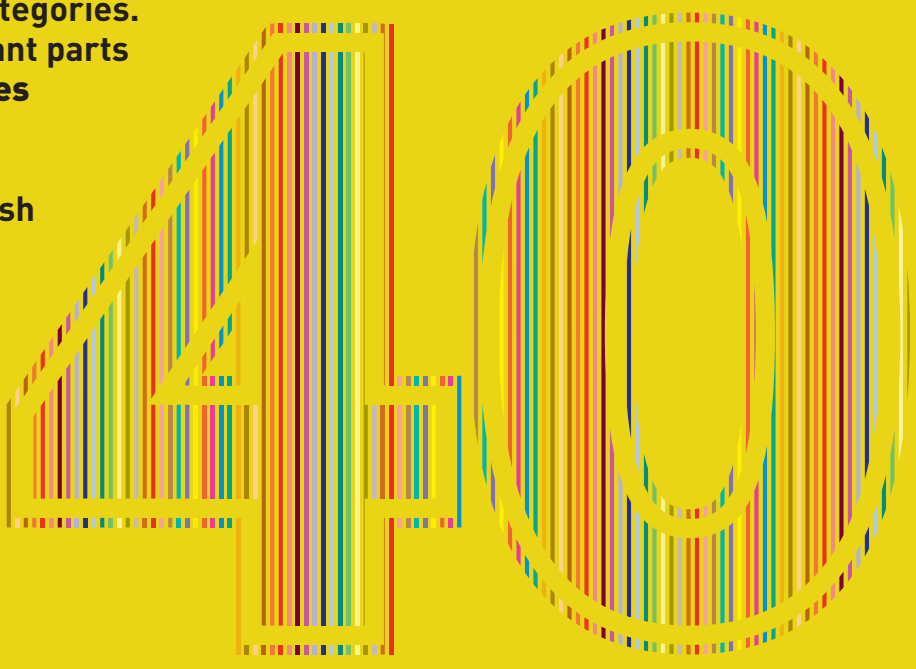
ISSUES IN SCIENCE & SKEPTICISM:
Fortieth Anniversary Celebration

This is the FORTIETH ANNIVERSARY YEAR of the COMMITTEE FOR SKEPTICAL INQUIRY and the SKEPTICAL INQUIRER.

For earlier anniversary observances, we presented essays by founders and early luminaries of the modern skeptical movement. For this one, we wanted to get the thoughts of noted skeptical leaders who have come to prominence in the most recent two decades.

Our invitations drew a strong and welcome response. They tended to fall into two categories. As a result we devote significant parts of this issue to essays on Issues in Science and Skepticism.

In our next issue we will publish those recounting Odysseys in Scientific Skepticism.



Promote Reason, Prevent Climate Catastrophes: Let's Get 'Er Done

BILL NYE

We had another Reason Rally in Washington, DC, this year. Like so many of us, I am concerned about women's rights and civil rights writ large. I am very concerned about so many of our leaders, who are continually confused about the traditional separation of our laws and their religions. I shake my head with every recitation of the pledge of allegiance that includes "under God." Although I love to sing "Take Me Out to the Ballgame" (I really do), I often head to the concession stand in time to miss the singing of "Deity Bless America."

But for me, right now in the summer of 2016, my overwhelming concern is human-caused global climate change. I strongly believe it's the most serious kind of trouble, and it's coming at us like a runaway train. Sure enough also, although astronomically it was not quite summer, it was a hot day. People largely stayed out of the sun by standing under the trees along the north and south sides of the Washington Mall's reflecting pool. It was a metaphor for humankind's first reaction to our changing climates: run away. But of course, Earth is it for us humans. There's no place to run. So, here's what I said:

Ladies and Gentlemen, boys and girls, skeptics, nontheists, and especially the believers who may be here, thank you all for including me in the events today. As we stand before this shrine to Abraham Lincoln, one of history's most thoughtful critical thinkers, I cannot help but feel that we are at a critical time, a turning point in the history of my beloved United States and the history of humankind.

Our ability to reason has helped us provide clean water, reliable electricity, and access to an electronic information infrastructure to a large fraction of people who live in the developed world. Critical thinking, reason, and science got us here. And these traditions will help us bring these technical advantages to everyone on Earth—and, dare I say it, change the world.

With these noble goals in mind, today citizens around the globe are dealing with enormous costs and extraordinary hardships associated with rapidly rising waters and weather events of the extreme kind. We have floods in Texas, terrifying windstorms in the central United States, flooding in southern Germany and France, the river Seine, Paris—the very city that hosted the most recent Conference of the Parties climate summit. There were 193 parties in attendance all hoping to work together to resolve this global-scale problem of atmospheric and oceanic warming—climate change—that has been heretofore largely ignored by most of us in the United States.

Through our enterprises, we have loaded the Earth's atmosphere with carbon dioxide, methane, and other greenhouse gases that are warming our world 10^6, one million times faster, than it has ever warmed in its four-and-half-billion-year history. Humankind has brought this on—humankind must address it. But today, our efforts have barely begun.

As an engineer and citizen of the United States, I cannot help but wonder why this is. Why is this country, which for over a century was the world leader in science, engineering, and innovation, not the world's leader in the renewable energy technologies and especially the carbon curtailing *policies* that we must create and put in place as soon as we can?

A handful of climate change deniers have managed to hoodwink us, to lead us to believe that there is some doubt among the overwhelming majority of scientists about the seriousness and consequences of global climate change, even as our

rivers overflow their banks. Without thinking much about it, we allow climate deniers to equate routine scientific uncertainty—plus or minus 2 percent, say—with doubt about the observable global changes altogether, which would be the equivalent of plus or minus 100 percent. When I express the situation with these percentages, we all can see that the deniers are obviously wrong or very much misled. The deniers often suggest that there is a worldwide conspiracy of scientists out to drive coal miners out of work. A conspiracy? Of 30,000 scientists? Have you ever spent any time with those people? It's just not reasonable. Yet a large fraction of us has gone along with deniers hardly questioning their inane argument and obstructionist policy proposals.

Climate denial is generational. Very few young people embrace those silly ideas. But what about the future? The kids? We cannot let them down.

Things change; the world changes. My grandfather went into World War I on a horse. He was, by all accounts, a skilled horseman. He rode around trenches, in the dark, and under enemy fire. But very few soldiers today need that skill. Today, the tasks and jobs needed to conduct a war have changed. In analogous fashion, a great many *jobs* will change. People in the extraction industries—those who mine coal or drill for oil and gas—today will one day soon be doing something else in the energy sector: welding wind turbine masts, manufacturing photovoltaic systems, or connecting neighbors to the Internet. We can do this. We can change the world.

In a month, a consortium of for-profit and not-for-profit organizations will open an amusement park with a religious theme in the Commonwealth of Kentucky. You may have heard about their activities. The Answers in Genesis ministry preaches that the discovery of evolution was and is somehow not real—and more urgently, they insist that our world is not warming. They promote this fiction among their followers.

To work at their Creation Museum or at their soon-to-open Ark Encounter bible-literal theme park, you have to testify to your faith in their faith. That might seem like a violation of our first amendment, which you can read from the original text just a few blocks east of here at the National Archives.

And, to finance these attractions, the organization apparently relies on a consortium of legal entities. Answers in Genesis is the main nonprofit. The Creation Museum LLC charges admission; it's a for-profit entity. The Ark Encounter LLC is an amusement park and is also a for-profit. But you may not hear much about another not-for-profit corporation: Crosswater Canyon, Inc. The "ministry," as it's called, uses Crosswater Canyon to get tax breaks. Their extraordinary claim is that this Ark Park is nominally a tourist attraction. Even though it *has a completely, relentlessly religious mission*, it is viewed—by the governor, his tourism cabinet, and a judge of the U.S. Eastern Kentucky District Court—as existing entirely for tourists. They claim the park will attract tourists of all denominations and beliefs and so is thereby entitled to tax breaks and virtually free real estate from Kentucky and her taxpayers. Answers in Genesis claims religious affiliation when it wants to discriminate in hiring and not-for-profit status when it wants to avoid paying taxes. While the entities of the consortium have passed legal tests in Kentucky, that happened only because the governor, the tourism cabinet members, and a key judge are all believers. They accept that their religion is not separated from their state or commonwealth, as it would be under other circumstances. I'll give Kentuckians a critical thinker's example: Imagine if the consortium were about to open something like the Mosque Kiosk, an amusement park or tourist attraction designed to promote the Muslim faith. Such a project would be quashed at once and by the very same officials who are enabling these biblical businesses to thrive.

To those of us here at the Reason Rally, doing our best to be reasonable, this would otherwise be a charming, if silly, bit of Americana. Something foreigners would shake their heads at. Something people in Kentucky universities and colleges in the surrounding area would apologize for continually. And that would be about that. However, there is something very much at stake here—*the future*.

I'm talking about the kids. If we raise a second generation of people within driving distance of these facilities—Kentuckians, Ohioans, Illinoisans, Indianans, West Virginians, and Tennesseans—who cannot think for themselves, we are all going to pay the price. We are all going to be burdened with reeducating and enlightening these kids and young adults. And just think about the economy in those areas. The workers in these nearby economies will not have been brought up with philosophical traditions, the processes of science and reason that help us all understand the world. I am certain the kids will not grow up with the tradition of innovation we and others expect from our citizens, who create search engines, smart phones, and electric sports cars.

I say this, because along with this consortium's weird lack of understanding of biology, geology, and astronomy, this consortium promotes the idea that the world

is not warming—that a deity will ensure that everything is fine despite the overwhelming, astonishing, and very troubling evidence to the contrary. So while it is a good feeling to be among like-minded people here at the Rally, there are troubles ahead unless we act this year.

I claim—and please evaluate my claim for yourselves—that this year is a turning point for us, for us humans. If we stumble forward and elect a climate change denier to be the United States president along with a cohort of deniers in other government roles, the entire world is headed for big global warming climate change trouble. If we delay another four or eight years, it will be difficult indeed for millions, perhaps hundreds of millions, of us to ever achieve a quality of life that you and I have come to expect in the twenty-first century. And by the twenty-second century, virtually all of humankind could be suffering deeply.

As this summer of 2016 unfolds, I acknowledge the possibility that an insecure, confused, and currently conservative man may, by reluctant default, become the most influential man on Earth in January of next year. If this happens, I'm sure a strong majority of us, conservative and progressive alike, would be very, very concerned for our future. What would we do?

Over the last few weeks, I've often reflected on a joke we used to share at Boeing. I used to work there—on 747s. Don't worry; I was very well supervised. The joke was about the fictional B-3 bomber. It would be flown by a pilot and a pit-bull. The pilot is there to watch the instruments; the dog is there to make sure that the pilot doesn't touch anything! If the current conservative presumptive nominee gets elected in November, I have a feeling we will all have to work like pit-bulls to make sure that when it comes to the U.S. government, he doesn't touch anything.

By the way everyone, you have to vote. For those of you who may believe that no candidate running for president right now is worthy of you, and so you will choose to not vote, would you please just sit down and shut up? So the rest of us, who do want to participate, can vote and get things done.

With all this, I acknowledge that we here at this gathering are a small minority. Although the fraction of our society that embraces reason over unreasonable claims, that embraces critical thinking over baseless anecdote and science over anti-science, is growing, we must all keep in mind that we are a minority, underdogs in the fight for reason. When my grandfather was a young man, there were fewer than one and half billion people on Earth. When I was a kid, there were fewer than three billion. Today there are well over 7.3 billion. And the overwhelming majority of these—six billion at least—are deeply religious. But it is no trouble to find common ground when the environment of the Earth is at stake. The pope's recent encyclical stands out as a commonsense assessment of our planet and its future.

As I often say, if you like to worry about things, you're living at a great time. We have suicide bombers, deadly drone missions, and now the Zika virus. It's very reasonable that more than a few of us have been infected here today. But, it's also a time in which we could be very optimistic. Reasonable studies by engineers and policy analysts have shown that there is enough *renewable* energy available to run all of this country, our neighbors to the north and south, and even the entire world if we just decided to do it. The sources of energy would be wind, concentrated sunlight, photovoltaic electricity, with some geothermal and tidal energy mixed in. The big potential source of energy here in the Eastern Time Zone, by the way, is wind off of our east coast. We could do it, if we just decided to get 'er done.

And for those of you who may be very skeptical of this claim, who think that we couldn't get it done, couldn't get renewable sources in place quickly, I give you this critically thought-through example. Both of my parents were in World War II; their ashes are interred across the river in the Arlington National Cemetery. My father was a prisoner of war captured very early in the war, in 1941 by the Japanese military from Wake Island. My mother, who I will admit was very good at puzzles, was recruited to work on the notorious enigma code. They were part of what came to be called the Greatest Generation. They didn't set out to be great. They played the hand they were dealt, and in barely five years resolved a global conflict. So must we. We must employ critical thinking and our powers of reason to recognize the problems of global climate change, play the hand we are being dealt, and get to work.

This summer, let's all work to promote reason. Let's remind our fellow citizens that each and every vote matters. Let's acknowledge and embrace the facts of global climate change. Let's go. With critical thinking and reason, we can find common ground. We can promote policies to reduce carbon emissions. We can develop and distribute what we need to provide clean water, reliable electricity, and access to electronic information to everyone on Earth. Together, we can change the world. ■

Bill Nye ("The Science Guy") educates millions about science and critical thinking via his television shows, public appearances, videos, books, and website. He is CEO of the Planetary Society and a CSI fellow.

What Science Is and How and Why It Works

NEIL DEGRASSE TYSON

If you cherry-pick scientific truths to serve cultural, economic, religious, or political objectives, you undermine the foundations of an informed democracy.

Science distinguishes itself from all other branches of human pursuit by its power to probe and understand the behavior of nature on a level that allows us to predict with accuracy, if not control, the outcomes of events in the natural world. Science especially enhances our health, wealth, and security, which is greater today for more people on Earth than at any other time in human history.

The scientific method, which underpins these achievements, can be summarized in one sentence, which is all about objectivity: "Do whatever it takes to avoid fooling yourself into thinking something is true that is not, or that something is not true that is."

This approach to knowing did not take root until early in the seventeenth century, shortly after the inventions of both the microscope and the telescope. The astronomer Galileo and philosopher Sir Francis Bacon agreed: conduct experiments to test your hypothesis and allocate your confidence in proportion to the strength of your evidence. Since then, we would further learn not to claim knowledge of a newly discovered truth until multiple researchers, and ultimately the majority of researchers, obtain results consistent with one anther. This code of conduct carries remarkable consequences. There's no law against publishing wrong or biased results. But the cost to you for doing so is high. If your research is rechecked by colleagues and nobody can duplicate your findings, the integrity of your future research will be held suspect. If you commit outright fraud, such as knowingly faking data, and subsequent researchers on the subject uncover this, the revelation will end your career.

It's that simple.

This internal, self-regulating system within science may be unique among professions, and it does not require the public or the press or politicians to make it work. But watching the machinery operate may nonetheless fascinate you. Just observe the flow of research papers that grace the pages of peer-reviewed scientific journals. This breeding ground of discovery is also, on occasion, a battlefield where scientific controversy is laid bare.

Science discovers objective truths. These are not established by any seated authority or by any single research paper. The press, in an effort to break a story, may mislead the public's awareness of how science works by headlining a just-published scientific paper as "the truth," perhaps also touting the academic pedigree of the authors. In fact, when drawn from the moving frontier, the truth has not yet been established, so research can land all over the place until experiments converge in one direction or another—or in no direction, itself usually indicating no phenomenon at all.

Once an objective truth is established by these methods, it is not later found to be false. We will not be revisiting the question of whether Earth is round; whether the Sun is hot; whether humans and chimps share more than 98 percent identical DNA; or whether the air we breathe is 78 percent nitrogen. The era of "modern physics," born with the quantum revolution of the

early twentieth century and the relativity revolution of around the same time, did not discard Newton's laws of motion and gravity. What it did was describe deeper realities of nature, made visible by ever-greater methods and tools of inquiry. Modern physics enclosed classical physics as a special case of these larger truths. So the only times science cannot assure objective truths is on the pre-consensus frontier of research, and the only time it couldn't was before the seventeenth century, when our senses—inadequate and biased—were the only tools at our disposal to inform us of what was and was not true in our world.

Objective truths exist outside of your perception of reality, such as: the value of pi, $E=mc^2$, Earth's rate of rotation, and that carbon dioxide and methane are greenhouse gases. These statements can be verified by anybody, at any time, and at any place. And they are true whether or not you believe in them. Meanwhile, personal truths are what you may hold dear, but there exists no simple way of convincing others who disagree except by heated argument, coercion, or by force. These are the foundations of most people's opinions. Is Jesus your savior? Is Mohammad God's last prophet on Earth? Should the government support poor people? Is Beyoncé a cultural queen? Kirk or Picard?

Differences in opinion define the cultural diversity of a nation and should be cherished in any free society. You don't have to like gay marriage. Nobody will ever force you to gay-marry. But to create a law preventing fellow citizens from doing so is to force your personal truths on others. Political attempts to require that others share your personal truths are, in their limit, dictatorships.

Note further that in science, conformity is anathema to success. The persistent accusations that we are all trying to agree with one another is laughable to scientists attempting to advance their careers. The best way to get famous in your own lifetime is to pose an idea that is counter to prevailing research and which ultimately earns a consistency of observations and experiment. This ensures healthy disagreement at all times while working on the bleeding edge of discovery.

In 1863, a year when he clearly had more pressing matters to attend to, Abraham Lincoln—the first Republican president—signed into existence the National Academy of Sciences based on an Act of Congress. This august body would provide independent, objective advice to the nation on matters related to science and technology. Today, other government agencies with scientific missions serve similar purposes, including NASA, which explores space and aeronautics; NIST, which explores standards of scientific measurement on which all other measurements are based; DOE, which explores energy in all usable forms; and NOAA, which explores Earth's weather and climate.

These centers of research, as well as other trusted sources of published science, can empower politicians in ways that lead to enlightened and informed governance. But this won't happen until people in charge, and the people who vote for them, come to understand how and why science works. ■

Political attempts to require that others share your personal truths are, in their limit, dictatorships.

Neil deGrasse Tyson, coauthor of the just-released *Welcome to the Universe: An Astrophysical Tour* (Princeton University Press), is an astrophysicist with the American Museum of Natural History. His radio show *StarTalk*, now in its second season with National Geographic Channel, became the first ever science-based talk show on television. He is a CSI fellow. This article is adapted by the author from the *Huffington Post*, November 21, 2015.

Why Skepticism?

STEVEN NOVELLA

Twenty years ago, I became actively involved in the skeptical movement when I and several others founded a humble local skeptical group. We were inspired by CSICOP (now CSI) and Skeptical Inquirer to add what we could to efforts to make the world a more skeptical place.

Over the past two decades, the skeptical landscape has changed quite a bit, but one constant has been the endless question: What is skepticism? What exactly do we do and why? As the movement has grown and diversified, the question has become only more complex.

What Is the Mission of the Skeptical Movement?

I have come to understand that scientific skepticism is a weird beast that is often difficult to understand, especially from the outside. We are not exactly scientists or journalists or lobbyists or educators, and yet we are all of those things to some extent.

I think the best way to explain scientific skepticism is that it is expertise in everything that can go wrong with science and belief, and it includes execution, communication, education, and regulation. It combines knowledge of science, philosophy, and critical thinking with special expertise in flawed reasoning and deception.

To understand this better, here is a list of what scientific skeptics promote and do.

Respect for Knowledge and Truth: Skeptics value reality and what is true. We therefore endeavor to be as reality-based as possible in our beliefs and opinions. This means subjecting all claims to a valid process of evaluation.

Methodological Naturalism: Skeptics believe that the world is knowable because it follows certain rules or laws of nature. The only legitimate methods for knowing anything empirical about the universe follows this naturalistic assumption. In other words, within the realm of the empirical you don't get to invoke magic or the supernatural.

Promotion of Science: Science is the only set of methods for investigating and understanding the natural world. Science is therefore a powerful tool and one of the best developments of human civilization. We therefore endeavor to promote the role of science in our society, public understanding of the findings and methods of science, and high-quality science education. This includes protecting the integrity of science and education from ideological intrusion or antiscientific attacks. This also includes promoting high-quality science, which requires examining the process, culture, and institutions of science for flaws, biases, weaknesses, conflicts of interest, and fraud.

Promotion of Reason and Critical Thinking: Science works hand-in-hand with logic and philosophy, and therefore skeptics also promote understanding of these fields and the promotion of critical thinking skills.

Science vs. Pseudoscience: Skeptics seek to identify and elucidate the borders between legitimate science and pseudoscience, to expose pseudoscience for what it is, and to promote knowledge of how to tell the difference.

Ideological Freedom/Free Inquiry: Science and reason can flourish only in a secular society in which no ideology (religious or otherwise) is imposed upon individuals or the process of science or free inquiry.

Neuropsychological Humility: Being a functional skeptic requires knowledge of all the various ways in which we deceive ourselves, the limits and flaws in human perception and memory, the inherent biases and fallacies in cognition, and the methods that can help mitigate all these flaws and biases.

Consumer Protection: Skeptics endeavor to protect themselves and others from fraud and deception by exposing fraud and educating the public and policymakers to recognize deceptive or misleading claims or practices.

Addressing Specific Claims: Skeptics combine all of the above to address specific claims that are flawed, biased, or pseudoscientific and to engage in the public discussion of these claims.

Cultural Memory: Skeptics as a whole act as the cultural memory for pseudosciences and scams of the past. Such beliefs tend to

repeat themselves, and remembering the past can be very useful in quickly putting such beliefs into their proper perspective.

Science Journalism: Many skeptics spend a large portion of their time doing straight science communication and journalism, which is important because science is so central to our mission. This is also an important skill to explore and develop because it is so rarely done well. Correcting and criticizing bad science news reporting, especially in the Internet age, has become a large part of what skeptics do.

What Topics Do We Cover?

Traditional skepticism addresses a very broad range of topics: all of alternative medicine, parapsychology, cryptozoology, conspiracy theories, scams, postmodernism, self-help, education, science and the media, neuroscience and self-deception, fringe science, and a long list of topics that have political, religious, or social implications: genetically modified foods, organic farming, free energy and other energy issues, climate change, creationism, miracle claims, faith-healing, prophesy, channeling—the list is massive.

There has been frequent discussion about which topics skeptics "should" cover. My approach has always been that everyone, of course, should feel free to cover whatever topics suit their interests, motivations, and talents. There are no right or wrong topics to cover.

There are, however, many considerations worth discussing. Skepticism is a method of applying science and critical thinking to all areas. It is worth thinking about how those methods relate to any particular topic of interest.

Here are some of the factors I consider when deciding what topics to address as part of my skeptical activism.

Teachable Moment: One very important criterion is this: Would addressing a claim or topic provide a useful teachable moment? Since one (if not the) primary goal of skepticism is education, this is a crucial criterion, and in fact it is often sufficient reason to address a topic.

This is the primary reason I have never addressed issues such as ghosts, Bigfoot, astrology, or the Bermuda Triangle (classic skeptical topics all). I honestly don't care at all about ghosts, and I agree that this has extremely low priority as an issue. However, ghost hunters engage in a variety of pseudoscientific activities and defend their claims with numerous logical fallacies.

There are many generic lessons about science and critical thinking that can be learned by examining any pseudoscience, and often the most obvious ones are the best examples.

I have also found that by examining the full spectrum of pseudoscience, I have been able to see recurring patterns that enable me to understand pseudoscience much more thoroughly and then apply those lessons to more important areas such as medicine.

Interest: Related to the teachable moment criterion is public interest. The whole point is to engage the public, and one technique for doing so is to go to where the people already are. The public is interested in ghosts, cryptids, and UFOs, and in fact they often learn pathological science from popular treatments of these topics.

Ghosts and UFOs are the hook; the payoff is scientific literacy and the ability to think a bit more critically.

If we leave these popular subjects to the charlatans, they will happily spread scientific illiteracy unopposed. This is, however, a great opportunity to teach the public about how science actually operates, mechanisms of self-deception, how to tell if a claim is valid, and how to detect pseudoscience.

Addressing pseudoscience and the paranormal is a way to popularize science, such as writing about the physics of *Star Trek* or the philosophy of *The Simpsons*. Ghosts and UFOs are the hook; the payoff is scientific literacy and the ability to think a bit more critically.

Impact: The relative impact or importance of an issue is definitely important, and nothing I write here should be interpreted as dismissing or minimizing that point. In fact, as the skeptical movement has matured over the past few decades I have noticed a definite shift to issues of greater social importance.

My primary issue is alternative medicine, the abject infiltration of fraud and pseudoscience into the institutions of healthcare. This results in the wasting of billions of dollars and diverting of research funds, and it causes direct harm to the health of individuals.

Other important issues we tackle regularly are vaccine refusal, global climate change, genetically modified foods, our energy infrastructure, future technology, teaching creationism and other pseudoscience in science classes, issues surrounding mental illness, the self-help industry, scams, racial or gender pseudoscience, and other issues that have a direct impact on people's lives and our civilization. We also may consider how much of an effect we can have. Some issues are more amenable to scientific information than others.

Expertise: The world needs all kinds of experts, and scientific skepticism is a legitimate area of expertise. It involves a deep knowledge of pseudoscience, the philosophy of science, mechanisms of deception, neuropsychological humility, scams, logic, and other aspects of critical thinking. This includes knowledge of the history of pseudoscience.

Within skepticism, individuals also tend to focus their writing and speaking on their area of scientific expertise. So, skeptical doctors focus on medicine, astronomers on astronomy, biologists on issues such as evolution and creation, physicists on free energy, and so on.

If we have a bias, it is toward the areas of expertise that also tend to attract people to the skeptical movement itself, but this is hard to avoid. It is also not simple to correct, and straying outside of our areas of expertise is not a good solution. At the very least, it takes a lot more work to address an issue about which I am not already fairly expert.

The world needs all kinds of experts, and scientific skepticism is a legitimate area of expertise.

Filling a Need: Very relevant to the question of what targets skeptics choose is who else, if anyone, is already addressing those problems. For example, reviewing evidence and establishing a standard of care for a particular issue within mainstream medicine is very important, but there are already professional societies that do that. All physicians and scientists should be skeptical, but in areas where mainstream scientists are already doing just fine at addressing misperceptions, physicians who have an expertise in skepticism are not needed and have nothing particular to add.

We tend to focus our efforts where there is the most need, meaning where there is a current lack of attention. Fringe ideas tend not to get attention from scientists, who don't want to waste their time. Whether or not this is a reasonable position is debatable, but meanwhile skeptics are happy to fill the void. As a skeptical neurologist, for example, I am not going to spend my time delving into and engaging in debate over the possible mechanisms of Parkinson's disease. There are scientists who are doing that. But I will engage with those claiming that near-death experiences are evidence for an afterlife because most scientists don't bother to do that.

Journalistic Integrity: This last criterion is a bit of a personal choice. Some journalists and outlets unapologetically advocate for a political ideology. Everyone knows the *Huffington Post* is a liberal news source, for example. Some journalists, however, try to be as politically neutral as possible so that they will be viewed as a fair arbiter of factual information and analysis.

Similarly, some skeptics combine their skeptical activism with ideological activism. I have no problem with this, and most are upfront about it. Some skeptics, however, choose to be political or ideologically neutral in their activism, except for a defense of science and reason. I think this can be helpful.

While I certainly do have political opinions, I try to keep them separate from questions of science and evidence. If, for example, I am discussing global warming, I want to focus on the science and not be dismissed as liberal. Or if I am writing about GMOs, I do not want to be dismissed as conservative or libertarian. That can still happen, sometimes simultaneously, because people make unwarranted self-serving assumptions, but it helps when it is untrue. My opinions on these and similar topics are informed

by the science, not my politics. This becomes a harder sell when you are also advocating for a political position. I also think it is helpful to have a movement that is based upon evidence and logic and is agnostic toward ideological positions or values, which are tangential.

Finally, it is more challenging to be neutral and unbiased when dealing with an issue about which you have a passionate ideological belief. You can make a reasonable argument for steering clear of such issues when trying to communicate objective science, or at least proceeding especially carefully. Otherwise you risk damaging your reputation as a science communicator.

What about Religion?

More often than not, the question of what skeptics do and what topics we address comes to the topic of religion. While I believe I have addressed all the relevant issues above, this is a common enough question that it is worth special mention.

No skeptical activist I know treats religious claims differently from any other type of claims. Any claim to empirical truth or scientific knowledge, whether based ultimately in religious ideology or social or political ideology, is fair game. The criteria I outlined above apply. Philosophical arguments are also fair game, as the tools of logic and critical thinking apply.

However, it is important to recognize that faith statements are simply different from scientific or philosophical statements. This does not mean they are exempt from critical thinking; it just means you need to be aware of the context and address them properly. This distinction, however, is often misinterpreted as avoiding religious claims, which is patently not true.

When a believer states that they believe something to be true based upon their own personal faith, there are a number of valid approaches. It is important to point out that the principles of freedom of religion and separation of church and state require that their personal faith not be imposed upon others. They don't have a right to make other people follow their faith, to deprive their children of the basic necessities of life, or expect government to legislate their faith.

Either the science stands on its own or it doesn't.

It is also useful to point out that beliefs based purely on faith are not subject to scientific analysis, and therefore they do not belong in the arena of science. They therefore cannot mix faith and science. Either the science stands on its own or it doesn't. You cannot legitimately use faith to rescue bad science from refutation or to render it immune to falsification.

This applies to faith-based beliefs that are not overtly religious. It is not uncommon for believers in alien visitation or extrasensory perception (ESP) to retreat to faith-based claims when the evidence does not support their position. They are effectively refuted by simply stating that they have left the arena of science and therefore have ceded this territory. If they wish to have a religion of ESP, then so be it, but they cannot simultaneously claim to be backed by science.

In other words, skeptics can address faith claims epistemologically without making the same epistemological error as the believer in order to falsely claim that empirical methods can disprove beliefs that are not empirically based.

Conclusion

Being part of the skeptical movement for most of my adult life has been extremely fulfilling and tremendously educational. After two decades, I still find it among the most rewarding work that I do. There is also a continued great need for the expertise and work of activist skeptics. We are engaged in work that will never be completed. Our goals are generational, to slowly move our species in the direction of science and reason.

Count me in until entropy prevails over my temporary biological processes. ■

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Science and Skepticism

LAWRENCE M. KRAUSS

"These are the times that try men's souls." This was true when Thomas Paine uttered these words, and they remain true today (though with a more inclusive gender reference). The fact that Donald Trump, a poster child of ignorance, duplicity, and hatred, could win the nomination of the Republican Party says a lot about the lack of talent leading that party, but it also says a great deal about the country. And what it says isn't good.

I am writing these words after listening to a speech that was just delivered in North Dakota by Trump discussing global warming ("we will stop any U.S. government support for U.N. global warming studies" and "we will kill the Paris agreement"), coal production ("we will restore coal miners' jobs"), and the environment ("we will end the EPA"). The speech has produced the intended reaction; I am upset enough to write about it. Of course, one should not read too much into these statements because Trump is notoriously disingenuous and will say whatever he can at that instant to appeal to any crowd.

Nevertheless, I have stressed in other writings that the real worry about Donald Trump is that he has no idea how ignorant he really is. To me, *that* is the real danger of allowing bloviating demagogues such as him to go on unchallenged. The man has clearly never questioned himself very much during his life, but, more importantly, no one close to him seems to have questioned his views either.

What I really want to discuss is the necessity of encouraging questions in all aspects of public and private life.

So, to leave the odious topic of Donald Trump, what I really want to discuss is the necessity of encouraging questions in all aspects of public and private life. This shouldn't come as a surprise in a magazine about skepticism, but even here I don't think it receives enough emphasis.

On the one hand, the religious mafia has effectively established a code of public discourse where it is viewed as inappropriate to openly question religious doctrine or even to ask rationally what evidence exists to underlie that doctrine. It may elicit some

discomfort all around to ask someone why he or she might be voting for Trump in the upcoming election, but while political debate usually degenerates, at least the question is fair game. However, to ask people why they are Christian, or to ask whether Jews believe any of the Old Testament stories or whether they agree with the violent, hateful, misogynistic message of the scriptures that young people are forced to recite when they are Bar Mitzvahed, would be considered an inappropriate offense in polite company or on television.

But more important than even this is the fact that the nature of educating children in the twenty-first century needs to change. When I was growing up, part of the purpose of education was to provide basic information that would be necessary when we became adults. But in the current world, information as currency has dropped in value. Anyone with a smart phone—which nowadays is almost everyone—can Google any information they want.

But the information you get depends on the questions you ask, both to retrieve the information and after you get it. The Internet has no filter, which means we must become our own filters. This requires training, and I am worried we aren't restructuring our educational system around that training.

Part of the problem of encouraging open questioning in the classroom is that teachers will not be able to answer all, or even most, of their students' questions. But this is not a bad thing. Just as parents should be encouraged to openly state "I don't know" when your children ask you questions, so too will only teachers who are comfortable with the material be willing to acknowledge their own limited knowledge. Following "I don't know" should come the phrase ". . . but let's see if we can find out." This search will lead along various blind alleys, but that again is a good thing. Knowing how to discard distrusted sources and how to check to see if sources can be trusted is the key to making progress in this information age.

Which, to return to the odious New Yorker, is why people such as Donald Trump are so dangerous. When Trump was asked who he turns to for information or guidance, he answered, with a straight face, that he asks himself! He trusts his gut, and he also claims he knows a lot. But any person who never checks information beyond their own *a priori* beliefs—be they a billionaire businessman surrounded by yes-men and yes-women or an Iman who claims the Earth is flat and anyone who says otherwise should be punished—is a danger to progress in society, at least if anyone else follows him or her. The thought that such people might attain positions of political power, either in the United States or in the Middle East, is repulsive.

I don't have a magic bullet for encouraging open questioning more broadly in society. If each of us practices this whenever we can in the public arena, it can't be a bad example to set, which is why I am happy to celebrate this fortieth anniversary of Skeptical Inquirer. The example it has set for the past forty years should encourage all of us, and while I would hope SI wouldn't be as necessary in the future, I suspect society will always be better if some journalists are willing to openly question prevailing wisdom. Thank you SI, and Happy Birthday! ■

The information you get depends on the questions you ask, both to retrieve the information and after you get it. The Internet has no filter, which means we must become our own filters.

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How Can Skepticism Do Better?

SCOTT O. LILIENFELD

I am delighted to contribute an essay to celebrate the fortieth anniversary of the Committee for Skeptical Inquiry (CSI) and its wonderful magazine, Skeptical Inquirer (SI), both of which I have been honored to be affiliated with for the past fifteen years. CSI and SI have ample reason to be proud of their myriad accomplishments. They have helped to make skepticism a household word in many quarters and brought tens of thousands of individuals—laypersons, students, and academicians, among many others—into the fold of the skeptical movement. Moreover, they have served as invaluable resources for scholars, teachers, and laypersons. In my field of psychology, CSI and SI have inspired thousands of college and high-school instructors to incorporate scientific thinking into their curricula. I am one of them, and I very much doubt that I would have developed my successful "Science and Pseudoscience in Psychology" undergraduate seminar at Emory University (see Lilienfeld et al. 2001) were it not for the tireless efforts and encouragement of CSI and SI.

I strive not merely to debunk erroneous beliefs but to understand why otherwise reasonable people often fall prey to them.

To be true to its mission, though, skepticism must be skeptical of its own endeavors (Novella 2015; see also Horgan 2016 for a well-intentioned but less than successful effort in this regard). Hence, in this essay I look to the future and pose the question of what the skeptical movement could be doing better to advance its laudable goals.

Before doing so, I should be up front about my biases. I am a psychologist by training, and I tend to think about pseudoscientific and otherwise questionable beliefs though a distinctly psychological lens. By that I mean that I strive not merely to debunk erroneous beliefs but to understand why otherwise reasonable people often fall prey to them (see also Shermer 2002). As fascinated as I have been in evaluating the evidence—or lack thereof—underpinning pseudoscientific and otherwise questionable claims, my deeper interest has long been in why seemingly rational individuals, including prominent scientists, are so often seduced by these claims.

Ultimately, one of our principal goals as skeptics is to impart scientific thinking skills to the general public and to stem the rising tide of pseudoscience in the media, on the Internet, and in everyday life, including in the worlds of politics, business, and the law. How well are we doing?

Skepticism: A Report Card

It is not entirely clear, but there is ample reason for soul-searching. Survey data suggest that the levels of uncritical acceptance of paranormal claims, such as beliefs in extrasensory perception (ESP), psychic healing, and astrology, remain distressingly high among the general public and college students, and may even have been increasing over

the past few recent decades (Ridolfo et al. 2010). Despite our concerted efforts, we still find ourselves in an age in which pseudoscience crowds out science on the airwaves and newsstands, and in which leading presidential candidates are convinced that vaccines cause autism and that our unassuming little planet has very likely been visited by extraterrestrials. To be fair, it is conceivable that without our valiant efforts to combat pseudoscience the levels of such beliefs might be even higher, especially in light of the misinformation explosion fueled by the Internet, cable television, and social media. At the same time, it may be high time to ask ourselves whether, and if so what, we could be doing better.

In this essay, I briefly touch on three major topics that I believe warrant substantially more consideration in the next four decades of the skeptical movement: (1) the extent to which our dual aims may conflict with or even undermine each other; (2) the effectiveness, or lack thereof, of our debunking efforts; and (3) the need to consider research on cognitive development in disseminating scientific thinking skills to the general public.

Conflicting Aims?

One issue that strikes me as meriting considerably more discussion is the principal aim of CSI and SI. Is our primary goal to serve as a "resource group" or "support group" of sorts for skeptics—to provide real-world and virtual forums in which we skeptics can share our knowledge and consort with like-minded thinkers? Or is our primary goal instead to boost the levels of scientific thinking among the populace and thereby diminish the levels of poorly supported and potentially harmful beliefs?

In my view, both are extremely worthy aims, and I do not intend to fall prey to the false dilemma fallacy by implying that we must necessarily select one goal or the other. Logically speaking, they are not mutually exclusive. At the same time, I have to wonder whether these two aims are to some extent operating at cross-purposes. To the degree that we talk mostly to each other at our own conferences and meeting groups, in our magazines, on our Internet blogs, and in other outlets, we may largely be forsaking our opportunities to change the minds of the general public. I also worry that we may fall prey to a false consensus effect (Ross et al. 1977), whereby we overestimate the extent to which others share our views as well as overestimate the effectiveness of our efforts.

Furthermore, by communicating mostly with each other, we may inadvertently be cultivating something of an "us versus them" mentality in which we regard individuals outside the skeptical movement to be largely unreachable (or, worse, not worthy of outreach). Like one of my intellectual heroes, astronomer and science writer Carl Sagan (1996), I have on occasion detected more than a whiff of arrogance among some of us in the skeptical movement, and I have no doubt fallen prey to this tendency myself from time to time. Resisting the temptation to perceive our critics as inherently foolish, stupid, or malicious can at times be challenging, especially when we are addressing claims that strike us as outlandish. But as soon as we commit the fundamental attribution error (Ross 1977) of assuming that erroneous beliefs in others are the products of their intrinsic dispositions—such as low intelligence or the inability to think critically—rather than of inadequate scientific training or of an understandable yearning for wonder, we may find it difficult to avoid communicating condescension and disrespect when communicating with them. Moreover, we may dismiss them prematurely as "true believers" whose views are unmalleable.

Perhaps my concerns are unwarranted or overstated. I hope so. Even so, I believe that it will be crucial for the skeptical movement to step back and take further stock of its long-term goals and how best to achieve them.

I believe that it will be crucial for the skeptical movement to step back and take further stock of its long-term goals and how best to achieve them.

The Effectiveness of Our Debunking Efforts

As skeptics, we spend much of our time attempting to dispel false and poorly supported beliefs. By doing so, we hope to bring the best available scientific evidence to bear on confronting pseudoscientific and otherwise dubious assertions. Ironically, though, we rarely pause to ask ourselves a critical question: Are our methods of challenging others' beliefs themselves consistent with the best available scientific evidence?

The psychological literature increasingly suggests that the answer to this question is a resounding "No." Many skeptics appear to be unaware that a rapidly growing body of research on the effectiveness of dispelling false beliefs suggests that debunking is far more difficult than most of us have long assumed. The "continued influence effect," also known as "belief perseverance," whereby false beliefs persist despite repeated efforts to correct them (Johnson and Seifert 1994), is a major and largely unappreciated challenge to the efforts of the skeptical movement. The continued influence effect may help to explain, for instance, why recent surveys of the general public reveal that nearly one in three parents believes that vaccines may cause autism despite persuasive evidence to the contrary (Heasley 2014).

In fact, much of this recent research points to the possibility of "backfire effects," whereby well-intentioned attempts to disabuse individuals of misconceptions paradoxically strengthens them. For example, when researchers have attempted to reduce unwarranted doubts regarding the dangers of vaccines by informing participants that the side effects of the flu virus tend to be mild and are rarely worse than the effects of the virus itself, they have found that participants tested immediately after reading this message are more receptive to flu vaccines than are other participants. Yet if researchers wait a mere half an hour, these effects are reversed—individuals become more dubious of flu vaccines than they would have been had they received no information at all (Schwarz et al. 2007; see also Nyhan and Reifler 2015)! Presumably, participants' negation tags—the "yellow sticky notes" in their minds that remind them "This belief is false"—have peeled off. Similar backfire effects have emerged in a number of other realms, including politics. For example, liberals informed that George W. Bush did not in fact ban all U.S. stem cell research, or conservatives informed that Iraqi dictator Saddam Hussein did not in fact possess weapons of mass destruction, subsequently become more likely to endorse these inaccurate beliefs (Nyhan and Reifler 2010). Backfire effects appear to be most likely when false messages threaten recipients' self-identity ("worldview backfire effects") and when the myths themselves are repeated frequently ("familiarity backfire effects"), in the latter case probably because people often confuse a message's familiarity with its accuracy. Both types of backfire effects should be of concern to skeptics, because we frequently challenge individuals' core self-concepts and do so by reiterating their misconceptions.

Are our methods of challenging others' beliefs themselves consistent with the best available scientific evidence?

Fortunately, psychologists and other social scientists are gradually converging on a set of evidence-based principles for effective debunking (Lewandowsky et al. 2012). In general, research suggests that effective debunking requires communicators to displace the false belief with a competing, and ideally more compelling, narrative. In addition, communicators should clearly—and respectfully—explain how and why the belief, although often understandable, can be misleading. Furthermore, debunkers should generally avoid repeating the myth too many times and instead focus on well-supported scientific evidence that counters the myth. If possible, pairing the debunking explanation with a vivid and easily grasped graphical depiction, such as a figure contrasting the tiny number of peer-reviewed studies suggesting a link between vaccines and autism versus the enormous number that do not, is also advisable. I strongly encourage interested readers to consult the brief and user-friendly *Debunking Handbook* by Cook and Lewandowsky (2011) at https://www.skepticalscience.com/docs/Debunking_Handbook.pdf for further recommendations.

More broadly, as the skeptical movement looks ahead to the

next four decades, it will need to revisit how it frames and packages its messages. It is plausible, if not probable, that we are not doing so in the maximally effective fashion. More worrisome, it is entirely possible that we are sometimes inadvertently hurting our cause. This possibility should give us pause.

Psychological Research on Child Development

The great Swiss developmental psychologist Jean Piaget got a number of details wrong; for example, he almost surely underestimated children's cognitive capacities in many domains. Nevertheless, Piaget imparted a crucial insight that has stood the test of time: Psychologically, children are not miniature adults (Lourenço and Machado 1996). They conceptualize the world in markedly, perhaps qualitatively, different ways than we do. As a consequence, we cannot assume that the same debunking approaches that work with grown-ups will be successful with children.

To be effective in our efforts to disseminate scientific thinking to the general public, we may need to begin early in individuals' lives, well before erroneous conceptions of the world have become ossified. Public health research teaches us that primary prevention is almost always more effective and efficient than secondary prevention, and the same principle is likely to apply to the teaching of critical thinking skills.

We know scandalously little about when in psychological development we can effectively begin to teach scientific thinking skills, or how to differentially craft scientific thinking approaches for children of different ages. Recent research offers some grounds for optimism. In two studies, a simple picture storybook intervention yielded encouraging success in teaching five to eight year olds about the key principles of natural selection; these effects endured for at least several months (Kelemen et al. 2014).

At the same time, there will inevitably be unanticipated challenges in teaching scientific thinking principles to children. In a brief article that should be required reading for all skeptics, Bloom and Weisberg (2007) described a number of deep-seated sources of psychological resistance to science that emerge in childhood but that probably persist—albeit in attenuated form—in adulthood. Among other things, these authors noted that young children tend to perceive purpose in many non-purposeful phenomena. For example, they commonly assume that clouds exist to make rain for people and that lions exist so that people can view them in zoos. Such teleological reasoning, dubbed "agenticity" by Michael Shermer (2009), may render children especially vulnerable to notions such as intelligent design theory, which posits that species arose from the intentional plan of a grand designer. In addition, Bloom and Weisberg observed that children are "natural-born dualists," meaning that they regard the mind as a nonmaterial essence that is fundamentally distinct from the brain. Such dualism may render children especially likely to embrace beliefs in ghosts, spirits, and other disembodied entities, which presumably reflect the persistence of the mind following the death of the brain. In many of us, these dualist beliefs probably endure in some form into adulthood, suggesting that this line of research bears fruitful implications for dispelling adult misconceptions as well.

In my view, one of the foremost challenges to the skeptical movement in future years will be to forge stronger linkages with such disciplines as cognitive-developmental psychology and educational psychology to better understand how to immunize children against erroneous beliefs—and more broadly, erroneous ways of thinking—before these propensities become deeply entrenched in adolescence and adulthood. The conceptual and methodological difficulties here are formidable, but the payoffs are likely to be substantial.

Concluding Thoughts

The skeptical movement has every right to celebrate its past forty years of remarkable achievements, but it should not rest on its laurels. To bring skepticism to the next level—Skepticism 2.0—we will need to take a much more critical look at the success, and lack thereof, of our communication and persuasion efforts. Gathering evidence against unsupported assertions is an invaluable and necessary first step, and skeptics have made admirable progress in this regard. But now we must begin to develop more effective means of disseminating the fruits of our labors to individuals who are skeptical of our skepticism. ■

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Time to Upgrade the Skeptical Operating System. Reboot.

SHARON HILL

Around 1992, I discovered a new sphere to explore—skeptical literature. Thus began my critical pursuit of topics I'd long been interested in: the paranormal, natural anomalies, and extraordinary claims. Application of the scientific skepticism approach reshaped and colored my personal identity and influenced my daily life. Skepticism became my operating system, an outlook and lens through which to view the world. It transformed who I am. I credit many sources for this change—my education in natural sciences, Stephen Jay Gould's verbose but elegant essays on evolution and the flaws of creationism, Skeptical Inquirer, and the Internet where I became "I Doubt It" to a worldwide network.

Ah, the Internet. It is both the source and the scourge of reliable knowledge; friend and foe of practical, everyday skepticism. It changed *everything*—for better and worse.

The skeptic community in the late 1990s consisted of brilliant, personable men, and only a few women, of academia and public celebrity. There was no shortage of gray hair, beards, neckties, and magic tricks at the first conference I attended in Burbank (CSICOP's Fourth

World Skeptics Conference in 2002). A few years later, in response to surging popularity of conservative Christian ideals that included the devaluing of science and reason in society, the skeptical community blossomed with an influx of science-appreciating people of younger years . . . and more interesting hair colors. We had an energized tribe.

We made best friends and then worst enemies. As with all communities, as novelty wore off we struggled for space, attention, and ways to advance our own personal priorities. Influenced by my immersive study of the relationship between science and the public, I promoted a critical thinking process to apply to everyday life, news stories, and strange ideas in society that sound promising and exciting. This resulted in projects such as my *Doubtful* blog (SharonAHill.com), the "Sounds Sciencey" column for CSI online (http://www.csicop.org/specialarticles/archive/category/sounds_sciencey), participation in the Virtual Skeptics web show, and the longest running, most popular skeptical-themed news site DoubtfulNews.com.

In cooperation with several other leaders in skeptical thinking, I developed the *Media Guide to Skepticism* (http://doubtfulnews.com/media-guide-to-skepticism/) in 2013 as outreach to the general public and journalists. It was designed to show what this "skeptical" thing was all about—that skeptics respect evidence, reason, and science, and we are aware of how we can be fooled or enticed by supernatural explanations. The word *skeptic* was associated with climate deniers, so it was necessary to point out the difference between those positions and emphasize that "skeptic" does not equate to "cynic" or "atheist" but is a process and approach to get the best answer.

To speak out with passion means you certainly will be criticized by those with opposing views. Active participation in the discourse means experiencing petty and frustrating attacks, as well as satisfying enlightenment and greater understanding. This is a position where one is challenged every day by others and by one's own self-doubt. It's not sitting in front of the TV and being spoon-fed information; it is about seizing the claim and examining the substance. It's about facing assessments and decisions with a sharp instrument to excise the rotten parts and fluff that can clog up the works and see what's really hidden underneath. Both inside and outside the skeptical community, I was on the receiving end of appreciation and a great many kindnesses, but I also became a target for rude and selfish actions by those who didn't like that I challenged their deeply held beliefs and positions of social authority.

Active participation in the discourse means experiencing petty and frustrating attacks, as well as satisfying enlightenment and greater understanding.

There is no neat and tidy guide for all that needs to be done, but that can't mean we do nothing and resign our society to the barrage of nonsense. There has always been, and will forever be, a wide array of subject areas that deserve a solid skeptical platform. In the sixteen years of the twenty-first century so far, we've seen a terrifying international resurgence in deadly belief in witches, exorcism, and cultural superstitions that target children, women, and those with genetic differences. The world is destabilized by social, political, and environmental conspiracies that undermine valid legal and policy decisions. The lonely and grieving are taken advantage of by psychic scammers and fear mongers on TV, online, and even in the streets of their hometowns. Daily attacks are fired against scientific knowledge and science education. And it's impossible to keep up with the endless parade of dangerous health claims, products, and "alternative" treatments pushed on the unsuspecting. Someone has to speak up and beat back the nonsense brigade, if only to hold the line.

Progress in any endeavor requires planning; investment of time, money, and effort; thoughtful objectives; and a cooperative attitude between colleagues of like mind. Unfortunately, these actions have not been successfully implemented in the last five years to advance critical thinking in popular culture. Foundation pillars of skeptical advocacy—organizations, networked groups, and individuals—have fractured and fallen away, resulting in a diminished

public presence. These foundations must be rebuilt through discussion, consensus building, planning, incorporation of technology, and new forms of outreach.

A strong skeptical presence, especially in the media, is not only acutely needed but noticeably desired. There is a guaranteed, albeit modest, portion of the audience that pauses to question the extraordinary claim. The skeptical view is expected to be expressed—it is sought out by journalists. We have to be ready to speak up! How can we craft that reasonable view and make it useful, palatable, and available to a broad audience?

Reasonable skepticism must become part of the fabric of information consumption. This must be a primary goal. It is past time to seek new leaders with new ideas and experienced professionals to ditch the old ways of doing things, expand beyond the traditional academic settings, and actively work toward shattering the cynical curmudgeonly old guy stereotype.

It can be done, but it requires a reboot.

To succeed, internally and in the public view, means showing respect for humanity. We can't fight among ourselves if we wish to move ahead as the much-needed voice of reason that people want to hear. Understanding, compassion, and focus are required to change the minds of those who have dangerous beliefs. I don't know how to go about gaining those qualities for a community, but I'm game to try. ■

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Why I Am Optimistic about the Future of Skepticism

RICHARD WISEMAN

I have always been somewhat skeptical. Even when I was eight years old, I had a sneaky suspicion that I was only seven! Just kidding. Actually, joking apart, I recently discovered that I was into skepticism at a surprisingly early age. When I was at school, a local bookstore used to come along once a month and sell their wares at a reduced price. My family was never one to resist a bargain, and so they encouraged me always to drink deeply from this fountain of cut-price paperbacks. A few weeks ago, I went into my parents' loft, looked through a box of books from all of those years ago, and was surprised to discover a large number of skeptical tomes. It turns out that while my more credulous classmates were being brainwashed into believing in fairies, pyramid power, and UFOs, I was reading the likes of *The Loch Ness Mystery Solved* and *Bigfoot On Trial* (apparently he was found guilty but escaped from prison and has never been seen since).

Fast forward ten years, and my enduring fascination with the science of the supernatural, coupled with an interest in magic, resulted in my enrolling for a degree in psychology at University College London (UCL). Way back then there was no easy way for people with the same niche interest to find one another. If, for instance, you were into trainspotting or taxidermy, your best bet was to hang around the relevant sections in a public library in the hope of meeting a fellow enthusiast. Quite frankly, it could be as terrifying as it was haphazard.

However, when I was in my second year at UCL I got lucky

because I discovered that one of the faculty—a psychologist named David Marks—was also interested in psychic stuff. A few years before, David had written a wonderful book called *The Psychology of the Psychic*, which was all about the techniques used by fake psychics to deceive people who hadn't read his book. David kindly agreed to meet up and introduced me to the world of organized skepticism. Over the next few years, I went along to meetings of the London Skeptics, discovered the joys of Skeptical Inquirer, and slowly became part of an extensive network of like-minded people.

After graduating from UCL, I moved up to Scotland and studied for a doctorate in the psychology of deception at Edinburgh University. I was then offered an academic position at the University of Hertfordshire, and that's where I have been ever since. For the first ten years or so at the University, I appeared on several television documentaries to offer a skeptical view about the paranormal. The format of these shows was almost always the same. They would feature a colorful, fun, and often emotionally touching recreation of an allegedly paranormal experience, and then a shot of me sitting in a bland studio arguing how this seemingly wonderful event was probably the result of misperception, fraud, or chance. It felt as if the program makers were stacking the odds against skepticism, and so it wasn't surprising that a large percentage of the public continued to believe in the paranormal.

And then something happened. Starting in the 1990s, the Internet slowly started to change the world. The web influenced skepticism in two major ways.

First, skeptics now found it much easier to both find one another and share information and resources. They no longer had to rely on hanging around public libraries or randomly bumping into one another at a social skills course. Within a short number of years, the size of skeptical meetings grew very rapidly. Whereas in the bad old days I would be standing on stage looking out on thirty faces, suddenly there were several hundred people in the audience.

Second, blogs, podcasts, and YouTube have provided us with a way of taking our messages directly to the public. For years, television commissioners and publishers had convinced themselves that skepticism simply didn't sell and so had produced very few documentaries or books that had a skeptical stance. Nowadays skeptical blogs, podcasts, and YouTube channels attract huge audiences and have proven that the alleged lack of public appetite for rationality and science was simply an illusion. Large numbers of people have always been, and will continue to be, interested in a skeptical take on the supernatural, and we now have a very direct way of communicating with this large audience.

I believe that we have a great future ahead of us. It is now easier than ever for skeptics to meet one another, share resources, and directly engage with the public. Because of this, more people than ever are discovering that fact is far more fascinating than fiction, and that's why I am optimistic about the future of skepticism.

Oh, and just before I forget, does anyone want to buy a used copy of *The Loch Ness Mystery Solved* or *Bigfoot On Trial*? ■

Richard Wiseman holds Britain's only professorship in the Public Understanding of Psychology at the University of Hertfordshire. His books have sold over two million copies, his YouTube videos have had over 360 million views, and he regularly speaks at skeptical events. He is a CSI fellow.

Authority and Skepticism

DANIEL DENNETT

When I was a child, the conversations around the dinner table in our house were especially vigorous and impassioned (as I soon learned when I discovered that I had to adjust my manner when I was a guest in other homes). When points of factual disagreement arose, this triggered the only grounds for being excused from the table in the middle of dinner: to look up the answer in the *World Book Encyclopedia*.

I remember vividly many occasions of triumphantly returning to the table, bulky blue volume in hand, to quote my vindication, and just as vividly the other occasions when I conceded defeat. I was wrong, and it says so right here in the *World Book*. The question of whether the *World Book* itself might be wrong seldom arose but was a recognized possibility.

Where would grownups turn today to settle similar disagreements? One of the unwelcome side effects of the mostly wonderful democratization of knowledge that has been ushered in by the age of the Internet is that we are losing consensus on what to consult when settling a bet. Sources of information that are *mutually recognized* as reliable—not perfect but reliable—are very useful assets for a society. If in the past we have often been overly submissive in the face of the epistemic authorities, today we risk swinging too far in the other direction and becoming knee-jerk, all-purpose skeptics. Skepticism across the board often sours into cynicism, and while a scattering of tolerated cynics in a society is probably a sign of health, when cynicism explodes into a pandemic, it can sap the enthusiasm of a people and threaten the security and coordination that permits a free society to operate. What people tend to forget is that all-purpose skepticism is too easy, a shtick that disables trust and makes resolute action on shared information more difficult.

We skeptics have a very important role to play of policing the epistemic environment, rooting out falsehoods and myths, and exposing charlatans and propagandists, but we cannot effectively do that job without endorsing and illustrating the *contrast* between these inferior and toxic products and methods and the (I use the word advisedly) *authority* of investigations done right. Does that mean that a good skeptic has to be some kind of *authoritarian*? Some kind of *elitist*? Yes. The good kind. Meritocracy has its place, and best practices are (usually) rightly called best practices. We must not be cowed by the chorus of oh-so modern (and postmodern) believers in epistemological democracy who decry the category of *expert*, replacing the distinction between amateur and professional with a lazy relativism that refuses to take sides.

How should we defend our acceptance of authorities when faced with the disapproving murmurs—sometimes rising to a roar—of *vox populi*? Carefully. We need to walk the tightrope between *appropriate* impatience with self-congratulatory ignorance on the one hand and on the other open-mindedness so tolerant that nonsense is granted "respect" that is mere lip service in any case. Like grade inflation, politically correct respect for all points of view threatens the quality control in thinking that modern society depends on, to put it bluntly. Not all points of view are equally "valid." One effective tactic is pointing out that these hyper-egalitarians know better than to trust their surgeries to amateurs or even novice professionals and wax indignant when they discover that somebody has *made a mistake* designing their car or advising them on how to make out their income tax returns. They settle for nothing less than expertise when it comes to the arrangements that affect their health, security, and comfort. They should have the consistency to honor expertise in other arenas as well. Moreover, when they point to the lapses and foibles in science, they invariably cite the policing campaigns of science itself, the most systematically self-critical institution the world has ever known. That should be enough (though of course it seldom is). ■

Daniel Dennett is the Austin B. Fletcher professor of philosophy and codirector of the Center for Cognitive Studies at Tufts University. His research centers on the philosophy of mind, philosophy of science, and philosophy of biology. He is a CSI fellow.

The Better Angels of Our Nature vs. the Internet

DAVID J. HELFAND

For 99 percent of the past several hundred thousand years of hominid development, our brains were evolving in social settings consisting of small (ten to thirty), mostly kin groups of hunter-gatherers. One great benefit of this arrangement is that it fostered altruism: as E.O. Wilson argues persuasively (*The Social Conquest of Earth*, 2012), a selfish person will always out-compete an altruist, but a group of altruists will always out-compete a group of selfish people. Those groups that cooperated in the hunt and shared the roasted zebra around the campfire prospered, while those who fought over the spoils of the day were eliminated from the gene pool.

There is a downside, however, to the social milieu in which our brains evolved: outsiders were considered (and probably often were) the enemy, *the other*. This instilled an innate fear and loathing of *the other* in the more primitive parts of the brain. The prefrontal cortex can, of course, override this (now often irrational) fear, but it works slower and takes effort. Part of that effort we call education; unfortunately, not all of our institutions engaging in education today put this role front and center in what they do.

For his commencement address at Columbia University this year, President Lee C. Bollinger, a noted First Amendment scholar, chose to explore some of the distressing challenges currently facing societies founded on democratic values (e.g., the recent election in Austria and the rise of authoritarian and xenophobic tendencies in many democratic countries, including our own). In particular, his concern was with the Internet and whether its characteristics were a significant contributor to these disturbing trends.

He sought to place the Internet in the context of communication revolutions of the past (the printing press, radio, television, and movies), and noted that when each of these new modes of mass communication became available, there was a reflexive reaction to worry about the chaos they might bring and calls for them to be regulated heavily lest they be misused to support totalitarian ends. In fact, these fears proved to be largely unfounded. He admonished us to keep that in mind when we decry the excesses of the Internet today.

It is an argument worth considering, but I would challenge it with a darker conclusion. The printing press, radio, and television, as implemented, did much to *open* people's horizons to the outside world. They brought new ideas, new peoples, and new cultures into purview, all within the safety of one's home, without the triggering fears that a direct confrontation with *the other* might induce. They are also media that are consumed passively—there is no opportunity for instant feedback—meaning there is time to reflect on what is read, seen, or heard.

The Internet is fundamentally different. It offers the consumer many ways to tailor the incoming information so that it conforms to his or her own (tribal) views: the "My News" app from the *Wall Street Journal* boasts that you can "customize your 'My News' collections to receive articles, videos, and slideshows from the columns, sections, industries, and companies you want." Not the range of opinion (such as it is) on the editorial pages, not

"A selfish person will always out-compete an altruist, but a group of altruists will always out-compete a group of selfish people."

columns that might challenge your views, or articles on unexpected topics, just the stories and opinions that conform to your (tribal) worldview.

The "My NPR" app and My *New York Times* are no different: they allow—even encourage and facilitate—the narrowing of the consumer's perspective. Furthermore, the Internet provides the possibility of both instantaneous gratification and instantaneous feedback, often in extremely negative and destructive ways; i.e., it plays to those primitive, instinctual parts of the brain that react when *the other* is spotted. As Frank Bruni wrote in a *New York Times* op-ed piece this summer, "We construct precisely contoured echo chambers of affirmation that turn conviction into zeal, passion into fury, disagreements with the other side into the demonization of it" ("How Facebook Warps Our World," *New York Times*, May 21, 2016).

Thus, I see the Internet as a qualitatively different kind of threat than the printing press or television. It is a powerful, free, global channel for propagating misinformation and disinformation. The devious tribesman who led his kin away from food supplies so he could have them all to himself was soon ignored or dispatched. Today, the climate change denier, homeopathic practitioner, or presidential candidate can easily, quickly, and cheaply raise armies of the uninformed, the gullible, and the disenchanted by providing their echo chambers with any endless diet of self-reinforcing nonsense. This undercuts any possibility that consumers can make informed personal decisions, and it poisons the climate for the creation of effective public policy.

Although the tsunami of misinformation may seem daunting, it is essential that we fight back. The Internet is a neutral repository, hosting arrant nonsense and solid evidence with unbiased equanimity. The rational mind prides itself on discriminating between the two. Popularity on the Internet comes from simply tallying "likes." Popularity in science comes from tested consistency with nature, the only arbiter that matters in the end. Education is the key to fostering an appreciation of these differences.

Our traditional model of education, however, centers on the transfer of information from teacher to student. That model is no longer relevant, since information is virtually unlimited, ubiquitous, and free. We must reorient our educational model to provide spam filters for the prefrontal cortex—a set of tools each student can apply in finding, vetting, and then using valid information to make personal decisions and to contribute rationally to civil society.

Abraham Lincoln ended his first inaugural address by appealing to "the better angels of our Nature." His context was the schism between North and South, and his appeal was to the common bond of patriotism in the American tribe that he hoped would save the Union. Today, our angels had better be hard-headed skeptical rationalists if we are to overcome the neotribalism the Internet fosters. May they sit lightly on our shoulders and support the next forty years of this crucial publication. ■

The Internet is a neutral repository, hosting arrant nonsense and solid evidence with unbiased equanimity. The rational mind prides itself on discriminating between the two.

David J. Helfand is a professor of astronomy at Columbia University, past-president and Vice-Chancellor of Quest University Canada, and past-president of the American Astronomical Society. He was elected a CSI fellow in 2004. He recently published his first book for the general public, *A Survival Guide to the Misinformation Age*.

Skepticism Evolves—and So Does the Paranormal

MARTIN BRIDGSTOCK

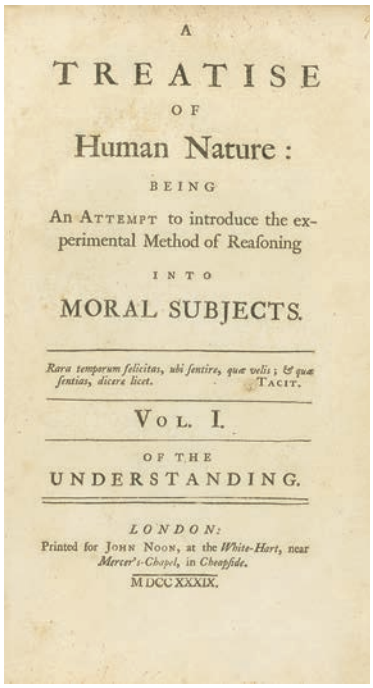
It is easy to find milestones in the history of skepticism. 1976 is important, of course. It's the date that the Committee for Skeptical Inquiry (CSI), formerly known as CSICOP, was founded. Before that, in 1952, Martin Gardner's great skeptical work was published. His book, eventually titled *Fads and Fallacies in the Name of Science*, is still in print, still selling, and still good. The Australian Skeptics was founded in 1981. And, way back in time, the great skeptic David Hume's *Treatise of Human Nature* "fell dead-born from the press" in 1739. It didn't stay dead, of course; Hume's arguments are still powerful today.

My own involvement with skepticism began in 1985. In my home state of Queensland, Australia, the creation scientists were on the march. With a fundamentalist premier (corresponding to a U.S. governor) and a fundamentalist minister for education, creationist demands for inclusion in school science teaching looked irresistible. I remember looking at some of their literature and noting that a vast mass of evidence seemed on the verge of sweeping away evolution. What's more, their claims were referenced to genuine scientific papers.

After long thought, I went to my university library and did some checking. Were their scientific quotes and references correct? To my astonishment, they turned out to be false on a grand scale. Quotes were altered and evidence misrepresented. Creationism, for all its righteous polemics, was a tower of falsehoods. I published my results in local magazines and journals. Then I joined the fledgling Queensland and Australian Skeptics. Checking records, we discovered a financial scandal among the creation scientists. Essentially, they had been swindled out of huge amounts of donated money and tried to keep it quiet (Bridgstock and Smith 1986). We publicized the scandal, and the politicians backed off in horror. A refugee from the defeat, Ken Ham, went to the United States where, I hear, he is rebuilding Noah's Ark.

Since the early days, skepticism has spread around the world. There are local groups, vocal individuals, and in some places, large national organizations. We can direct a withering blast of criticism and contrary evidence against paranormal claims, and often we can discredit them. On the other hand, judging by assorted polls, the overall level of paranormal belief remains high, at something over 70 percent (Shermer 2011).

I tried to tackle this directly, offering a skeptical course at my university. It intrigued and involved many students, and research showed that many picked up, and continued to use, skeptical ideas. I won prizes for the course, and many participants loved it. One student wrote, "MARTIN, YOU DESTROYED MY FANTASY WORLD!" on a feedback form. Sadly, after thirteen years, management concluded that the course was not what the university wanted, and it was wiped out.



A

TREATISE

OF

Human Nature:

BEING

An ATTEMPT to introduce the experimental Method of Reasoning

INTO

MORAL SUBJECTS.

Rara temporum felicitas, ubi sentire, quæ velis; & quæ sentias, dicere licet. TACIT.

VOL. I.

OF THE

UNDERSTANDING.

LONDON:

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My strong impression is that paranormal beliefs are evolving to render themselves proof against skeptical criticism. One type of defense was described by Paul Kurtz (1998) as the "unsinkable rubber duck" phenomenon. Paranormal claims

are made. They are criticized and disappear. Then they pop up again in a slightly different guise. Skeptics are reduced to playing whack-a-mole. Another way in which paranormal claims can survive is to structure themselves so as to be proof against criticism. Conspiracy theorists

are not affected by counterarguments; by definition, the critics must be part of the conspiracy. Creation scientists and climate change deniers are not affected by science-based criticism; after all, scientists are either atheists or crooks madly in pursuit of grant money. Either way, their criticisms need not be heeded.

Skepticism too is changing. A truly wonderful development is the influx of younger skeptics, including an appreciable percentage of women. The importance of younger skeptics is obvious; we oldies are not immortal, and skepticism needs younger people to carry on the fight. The appearance of many women skeptics is equally important, and not only because half of humanity's brains are in female bodies. One thing I have learned is that female skeptics see things that men do not see. For example, many woo practitioners target young mothers. Naturally, the mothers are anxious to take care of their children, and the peddlers play on this anxiety. Women skeptics may be better placed to see and combat this.

Skepticism is developing and spreading into areas the founders could not have envisaged. One such development is the guerrilla battle being fought on Wikipedia. The remarkable Susan Gerbic (2016) has led a movement to keep badly evidenced paranormal claims out of this important source. An encouraging feature is that when a dispute arises between a skeptic and a woo pusher, the encyclopedia's editors do see the skeptics' points. Skepticism is spreading in other ways, too; Indian skeptics are going into villages in that country and demonstrating the falsity of paranormal claims. This is genuinely dangerous work (Barry 2013), as is showing skepticism when violent Islamists are around; it can be lethal, and has been. We need to support our brave counterparts in other countries.

Overall, I suspect, the task of the skeptic is not getting any easier. Our movement is broadening and becoming larger and more diverse. At the same time, our paranormal quarry is becoming both craftier and more stubborn. In some cases, they can produce protective coloring that makes them look like scientists even though they aren't. I don't doubt that skepticism is here to stay. Sadly, I suspect that the same can be said of woo. ■

Paranormal claims are made. They are criticized and disappear. Then they pop up again in a slightly different guise. Skeptics are reduced to playing whack-a-mole.

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Alternative Medicine Is a Playground for Apologists

EDZARD ERNST

"What will you do if your conventional medical colleagues turn out to be skeptical about your research?" This question created an embarrassed silence during the press conference arranged in 1993 by Exeter University on the occasion of my appointment to the first chair in "complementary medicine." I had already explained how I would conduct my research into alternative medicine and all had gone well, but nobody had anticipated this question. My answer was spontaneous: "I don't worry about that, because I will be more skeptical than they are." There was a somewhat relieved giggle in the room, and even Sir Maurice Laing, the sponsor of my chair and a known proponent of alternative medicine, smiled.

At the time everyone seemed to think that I had wriggled out of a tight spot, and nobody seemed to believe that, for me, the answer was as truthful as it was obvious—how else could one approach research into such a controversial subject?

I had come from Vienna, where I had been head of a large department of rehabilitation medicine. We had routinely used alternative treatments such as acupuncture and spinal manipulation, but I was keenly aware that most of these therapies are not solidly grounded in evidence. In fact, it was precisely the plethora of open questions that fascinated me about the Exeter post. It was clear to me that progress in alternative medicine had to come from applying the tools of science to it. And it was equally clear to me that, as a scientist, one needed to be skeptical.

"An uncritical scientist is a contradiction in terms," I kept telling everyone. Most people nodded approvingly, except those who were keen on this or that alternative therapy—they looked puzzled. At first, I did not quite understand why, but later I found out the hard way.

The proponents of alternative medicine, I soon discovered, were divided into essentially two overlapping camps: those who were outright hostile toward my plan of using science for investigating their pet therapy and those who felt that science might be a good thing—because it could bring recognition and acceptance—but it had to be done "sympathetically." By that term they basically meant that investigations had to be designed and conducted such that the results could not possibly shed a negative light on their often weird concepts.

After more teething problems than I had bargained for—my recent memoir, *A Scientist in Wonderland*, 2015, provides the full details—I managed to assemble a team of motivated researchers and started my task of applying science to alternative medicine. Over the twenty years that followed, we published well in excess of 1,000 peer-reviewed articles, including about forty clinical studies and 300 systematic reviews. Their conclusions rarely delighted the proponents of alternative medicine. In fact, many apologists were upset or even outraged by our findings, and one day I was depicted as "the quack buster" in *The Times*. I felt this was flattering but wrong; I was an independent scientist trying to establish the facts.

Among my fellow researchers, I did stick out like a sore thumb. Most of them were "clever" enough to secure funding by conducting research along the lines mentioned above. They published surveys *ad nauseum* showing that alternative treatments were popular, thus implying or overtly stating that they must be effective and should be made available to everyone. Alternatively, they conducted clinical trials that were designed to generate the desired result (e.g., Ernst and Lee, "A Trial Design That Generates Only 'Positive' Results," *Journal of Postgrad Medicine*, 2008, 54(3): 214–6). In other words, they used the tools of science to demonstrate the value of their assumptions. That science is best employed when rigorously testing hypotheses seemed to be an irrelevance.

Alternative medicine, I began to realize, was (and is) a playground for apologists-turned-researchers who bend over backward to avoid publishing negative findings. It is dominated by individuals producing one positive result after the next (see paper referenced earlier). How can this be? Does it mean that everything works? Or does it show that these "scientists" are perhaps not all that trustworthy? If we agree that the latter option is more plausible than the former, should we not discontinue funding their research?

Thoughts such as these were rarely taken as criticism necessary for progress; they usually were considered as hostile attacks from someone who, in the view of alternativists, ought to promote their field. But promotion had never been on my agenda.

Eventually my criticism of the worst excesses of quackery got me into serious trouble. To cut a long story short—again my memoir provides the details—I had dared to publicly disagree with a report commissioned by Prince Charles, one of the United Kingdom's most influential advocates for alternative medicine. This prompted an official complaint from his office and a thirteen-month investigation by my own university. Eventually, I was pronounced innocent, but all support from my institution ceased, the funds dried up, my staff was dismissed, I had to go into early retirement, and my unit is closed down for good.

Since my retirement, I have started a blog for the general public with the aim of counterbalancing the plethora of misinformation on alternative medicine. I am also about to publish a book titled *Homeopathy, the Undiluted Facts*. Last year, I was awarded the John Maddox Prize for standing up for science.

All of this would be fairly trivial if it were without impact. But the success of U.K. skeptics (by no means just mine) is quantifiable and, I think, impressive. For instance, the formidable Nightingale Collaboration, of which I am proud to be a member, recently revealed that the expenditure of the NHS for homeopathy declined by 95 percent between 1996 and 2015.

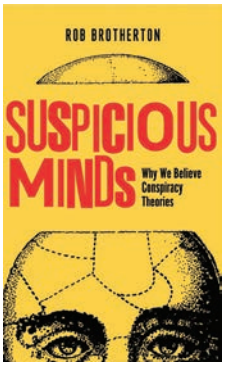
My advice to skeptics? First, I would urge them to more clearly differentiate between important and trivial subjects. Fraudulent health care can cost lives and therefore seems much more relevant than some of the other subjects that skeptics often tackle. Second, I would advise some fellow skeptics to take off their blinders. If anyone tells me that no evidence, however sound, can convince him or her to accept that a given alternative therapy works, I ask myself where is the line between skepticism and denialism? Finally, I feel that we are often too detached, abstract, and polite. Our opponents tell so many lies about us that we should consider telling the truth about them. ■

Our opponents tell so many lies about us that we should consider telling the truth about them.

Edzard Ernst, MD, PhD, is emeritus professor at the University of Exeter, United Kingdom. A world-renowned critic of alternative medicine, he has published 1,000 peer-reviewed articles, including about forty clinical studies and 300 systematic reviews. He is a CSI fellow.

Our Conspiracy-Generating Brains

STEVEN CALDWELL BROWN



Suspicious Minds: Why We Believe Conspiracy Theories. By Rob Brotherton. Bloomsbury Sigma, New York, 2015. ISBN 978-1472915610. 304 pp. Softcover, $27.

There has been an explosion of academic interest into conspiracy theories in recent years, marked by a flurry of journal articles (see "The Psychology of Conspiracy Theories" series in *Frontiers in Psychology*, for instance), doctoral theses, and books. Research into conspiracy theories nonetheless remains relatively niche, meaning that only a handful of scholars are well-positioned to produce a comprehensive book on the topic, drawing from empirical research. Rob Brotherton is one of them. Unlike most books on conspiracy theories, Brotherton's *Suspicious Minds* does not go into much detail on conspiracies themselves but instead the thinking behind them—*why people believe in them*. Critically, he explains clearly up front that we are all conspiracy theorists. With this in mind, the book ought to be of interest to everyone.

Adopting a psychological approach, Brotherton explains, "Conspiracism is a lens through which the world can be viewed, and it has the potential to distort everything in its field of view." Accordingly, he explains that the real culprit behind conspiracy theories is the human brain. We all have one, and this is why we all tend to believe in conspiracies. He clarifies that the prototype of a conspiracy is an unanswered question considered by a person who assumes nothing is as it seems. Those behind conspiracies are seen to be exceptionally competent, and normally not evil. Conspiratorial thinking is founded on anomaly hunting and is essentially irrefutable: "Attempting to refute a conspiracy theory is like nailing jelly to a wall. Since conspiracy theories are inherently unproven, the theory is always a work in progress, able to dodge refutation by inventing new twists and turns." Notably, belief in one conspiracy theory is found to be a strong predictor of belief in other conspiracy theories—even when they are contradictory. The appeal of conspiracy theories is rejecting "the official story."

Though drawing mostly from academic research, case studies of real conspiracy theories are present, none more prominently addressed than the MMR vaccine controversy, resulting in the retraction of a study published in *The Lancet* in 1998 that made the claim that the vaccination causes autism. Less well known, perhaps, is the issue of AIDS denialism. In 1992, businesswoman Christine Maggiore tested positive for HIV. With no medical training or degree, Maggiore pondered the scientific literature on AIDS and concluded it was not caused by HIV. Founding a group called "Alive and Well AIDS Alternatives," she, with the help of the rock band Foo Fighters, staged a benefit concert. She died of AIDS, having rejected AIDS medicine; her HIV was transmitted to her children, with one of her daughters dying of AIDS before she reached four years of age.

Rich accounts scattered throughout the book underscore the practical implications of beliefs "gone wrong" and the need for improved scientific communication between researchers and laypersons. Discussing the role of expertise in some detail, and with reference to some fun research, Brotherton notes that the world has become more complex and specialized—we increasingly rely on experts to help us make sense of it. The book is very accessible yet goes into a lot of detail on the research methodology used in empirical studies. My favorite method comes from J.E. Uscinski and J.M. Parent's 2014 book *American Conspiracy Theories* (Oxford University Press), which analyzed thousands of letters to the editor in the *New York Times* and *Chicago Tribune* between 1890 and 2010. It is clear that interest in conspiracies far predates the Internet.

In a lengthy discussion of our love for stories, Brotherton argues that conspiracy theories, ultimately, are stories not unlike those we have been telling each other throughout the ages. "Conspiracy theories are an exercise in connecting dots," he explains. "Reality is overflowing with dots. To make sense of it, our brain has to be good at quickly figuring out how they are connected. In its relentless quest to turn the chaos around us into meaning, however, our brain can conjure up seductive illusions." This is known from a wealth of related research, as summarized in Daniel Kahneman's 2011 book *Thinking, Fast and Slow*.

Going into detail on recent empirical works, Brotherton convincingly shows that people who are prone to believing that climate change is a

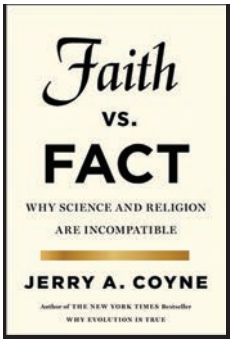
myth, that Princess Diana was "taken out" by the British Monarchy, or that Hurricane Katrina was "created" by the Bush administration using secret military weather manipulation technology have other things in common too. Fans of social cognition will be excited to read about intentionality bias, false consensus effect, proportionality bias, and other shortcuts that predict belief in conspiracy theories. To hone in on research into the belief that President Barack Obama is not in fact a U.S. citizen, research findings highlight that this perception *increased* after he released his birth certificate. Concluding that the so-called backfire effect is the ultimate demonstration of confirmation bias, Brotherton acknowledges, "Being smarter or having access to more information doesn't necessarily make us less susceptible to faulty beliefs. Sometimes it just makes us better able to explain away unpalatable facts." Once again reminding us that we are in fact all conspiracy theorists, the book serves as a useful reminder that we could all think more critically.

As we increasingly turn to the Internet to help us make decisions on all sorts of things, and as search results become iteratively refined based on our preferences, we must strive to better criticize the sources of information we encounter and adopt the point of view of others. This book, with its emphasis on a fun topic likely to be of interest to various parties, ought to help move things forward, if only a little. That is, of course, assuming that the book itself is not thought of as a tool of a conspiracy. ■

Steven Caldwell Brown is a psychologist and currently a teaching fellow in social psychology at the University of Edinburgh. His doctoral thesis was the first major body of work to examine psychological aspects of digital music piracy. He continues to research varied aspects of digital music culture as well as exploring psychological aspects of believing in conspiracy theories.

Why Science and Religion are Irreconcilable

JAMES M. CLARK



Faith vs. Fact: Why Science and Religion Are Incompatible. By Jerry A. Coyne. Penguin Books, New York, 2016. ISBN: 9780143408269. 311 pp. Softcover $18.00.

Jerry Coyne is a highly respected evolutionary biologist who blogs regularly at whyevolutionistrue.wordpress.com about the relationship between science and religion—a relationship that he has concluded after wide reading, reflection, and debate is antagonistic.

Coyne's argument is that both science and religion purport to make truth claims but rest on radically different and incompatible methods of determining the truth.

It will help, first, to appreciate what Coyne does *not* argue. He does not argue that science and religion are logically inconsistent with one another or that individuals cannot entertain both religious and scientific belief without any contradiction being perceived (at least not by them). For example, he acknowledges the latter and identifies a number of top tier scientists who are nonetheless religious in a somewhat traditional sense. Rather than demonstrate compatibility, however, Coyne simply sees examples of how people can entertain contradictory beliefs, in part because of such psychological factors as cognitive dissonance.

Instead his argument is that both science and religion purport to make truth claims but rest on radically different and incompatible methods of determining the truth. The methods of science lead to modification and improved understanding of phenomena, whereas the methods of religion support a static worldview that fails to improve over time its impoverished understanding about how the world works.

Chapter one articulates the basic problem, namely the perceived conflict between science and religion, as manifested for example by marked differences in religiousness of scientists and the wider population of American citizens or by such incompatible claims as the age of the Earth. Here he notes that the depth of conflict is demonstrated by the intensity of debates over the issue and by ex-

pensive efforts to demonstrate compatibility, in particular by the Templeton Foundation.

Chapter two attributes the incompatibility of science and religion to the fundamental properties of scientific methods, or its *toolkit*, the term Coyne uses. To illustrate one such tool, science rests fundamentally on efforts to disprove hypotheses about how the world works through observation. Coyne relates how disturbed he first was in graduate school at the seemingly hostile way in which scientists attacked and criticized each other's ideas, only to realize later that strong challenges were necessary for science to work.

In contrast, religions adopt an uncritical acceptance of their fundamental beliefs, and in some dominant religions even to question basic tenets is to be an apostate. The apparent moderation of religions in the West (e.g., we no longer burn people at the stake for sacrilege) might wrongly be attributed to an internal process of change but is more likely due to increasing secularism, that is, the loss of religion—something that has yet to happen in too many parts of the world. Other methods in the scientific toolkit demonstrate similar irreconcilable contrasts with religious approaches to belief.

Chapter three describes the accommodationist view that science and religion are compatible, a view promoted by scientists such as Stephen J. Gould, who argued that the two occupy nonoverlapping magisteria, for which he coined the acronym NOMA. Against this view, Coyne documents compelling evidence that most religions and religious people in fact do purport to make truth claims, such as that God exists, that Christ died and was resurrected, that Muhammad miraculously multiplied food and water, or that Joseph Smith translated the Book of Mormon from golden tablets that he found in 1823.

Not only do such claims often contradict one another and science, but their evidentiary base is so feeble compared to the standards of science as to merit much skepticism about their validity. Somewhat ironically, believers of one religion will often point out flaws in another without recognizing that the same criticism holds for their own belief system. Another weakness of many attempts at accommodationism is that they espouse such a watered down version of religion as to be unrecognizable and almost certainly to be rejected by followers of most religions.

If the world was not regular and knowable, then science would fail, which it clearly does not.

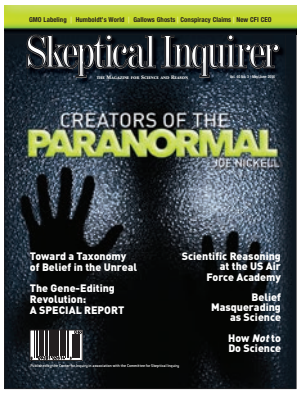
Chapter four addresses some ways that people of faith have struck back at threats from science. One approach that Coyne calls "natural theology" is to try and base theological claims on scientific grounds. For example, some argue that the so-called fine-tuning of the conditions for life on Earth is evidence for the hand of God. Others look to base supernatural events, including religious ones, on some of the weirder aspects of quantum physics. But the flaws in such arguments have been convincingly discredited by such physicists as the late Victor Stenger and are nicely summarized here.

A second response of believers and their academic allies is to argue that there are ways of knowing other than science. Coyne accepts this premise but argues that these putative other ways of knowing provide solid evidence for justified beliefs about the world only to the extent that they adopt the standard methods of science. He also deals with related criticisms leveled at science: charges such as scientism, or that science is unreliable, that it leads to bad ends, and that it is itself based on faith. To illustrate the tone of Coyne's counterarguments with respect to the last, scientists believe in the regularity and knowability of the world not because of faith but rather because of the tremendous success of a science based on those premises. If the world was not regular and knowable, then science would fail, which it clearly does not.

The fifth and final chapter documents why it matters how people derive their beliefs and the validity of those beliefs. People make decisions and take actions based on their beliefs. If disease is viewed as punishment for sins in a past life, attributed to a curse by a witch, or amenable to cure by praying to a god, then people will behave differently than if they appreciate the true nature of the ailment and take appropriate science-based action to treat and even prevent the disorder. In this chapter, Coyne takes on such issues as the controversy over vaccination, denial of global warming, and religious arguments against assisted dying, a topic now under much discussion in Canada.

Will people be persuaded by Coyne's thoughtful case for the incompatibility of science and religion and the strengths of the former? Probably not those strongly wedded to a religious worldview that defies criticism, although even they will benefit from Coyne's balanced representation of literature arguing the religious view. On the other hand, the increasing numbers of people leaning toward a modern secular worldview will find much here to appreciate and much on which to build a solid foundation for a life based on reason and science. ■

James M. Clark is Professor and Chair of Psychology at the University of Winnipeg. As a cognitive psychologist and practicing scientist, he has studied the nature of science and the substantial critical literature that claims wrongly to undermine its status as the best way to determine the validity of our beliefs.



Building the Pyramids

In "Creators of the Paranormal" (May/June 2016), Joe Nickell refutes Erich Von Däniken, partly relying on the Egyptians' supposed use of "great earthen ramps" of which "traces still exist."

It is my understanding that the great ramp scenario has been overturned as wildly impractical (if not practically impossible), and there is no reliable evidence of such ramps.

In any case, there have been convincing demonstrations of a much more practical technique. A small group of laborers levers a stone block upward, alternating ends of the block and inserting cribbing, until the stone is just above the next course. The stone is then moved horizontally onto that course (actually onto a first layer of cribbing), and so on. Not only is this method inherently more efficient (no extraneous material and no moving or compacting it), but the process can be scaled up indefinitely, just by adding more work groups.

In any case, I certainly agree that space aliens weren't needed to build the pyramids.

Steve Weinreich
Mount Desert, Maine

Editor's Note: We asked anthropologist Kenneth L. Feder, a CSI fellow and author of Encyclopedia of Dubious Archaeology, *to comment on Mr. Weinreich's letter. He wrote:*

There is definitive evidence for the use of ramps—some of their remains have been found—but Mr. Weinreich raises an important point. A ramp makes great sense but only for the lower courses of the pyramid. To maintain a reasonable slope to raise pyramid blocks to higher levels, the ramp has to be extended and would have been a bigger construction project than the pyramid itself. Levering can work, but the irregular surfaces of the core blocks would have rendered the exclusive use of levering problematic and dangerous, as shown by experiments using that process. In their 2008 book, The Secret of the Great Pyramid, *French architect Jean-Pierre Houdin and Egyptologist Bob Brier have proposed the "internal ramp hypothesis." Here, an internal, gently rising, corkscrewing ramp was built as a permanent part of the body of the pyramid. Microgravimetric imagery lends some support of this hypothesis, and this technique explains some heretofore enigmatic features within the pharaoh Kufu's pyramid. See the Brier and Houdin book and the 2008 National Geographic documentary "Unlocking the Great Pyramid" for the details of this approach. And yes; however it was done, it was Egyptians and not aliens.*

Test of Titanium Necklaces

Drs. Foster, McClernon, and Reich ("Scientific Reasoning at the U.S. Air Force Academy: An Examination into Titanium-Treated Necklaces," May/June 2016) present an interesting account of their classroom experiment exploring the potential mood-affecting power of titanium-infused Phiten necklaces. Their results suggest that the Phiten necklace does not significantly alter the wearer's sense of well-being any more or less than a necklace made of clothesline.

I am curious, though: The authors state that Phiten declined to provide them the titanium mass weight percent of their necklaces, so they could not compare it to the trace amounts of titanium found in the soil samples they analyzed. Why didn't the authors take it upon themselves to determine the titanium mass weight percent of one of the Phiten necklaces? Is that because Phiten claimed it to be a "corporate secret"? Without numbers to compare, the soil sample numbers don't really say very much. And for that matter, why not analyze the clothesline as well? For all we know, the Phiten and clothesline necklaces might both contain trace quantities of titanium comparable to what was found in the soil samples, in which case, no significant conclusions could be drawn as to the influence—or not—of titanium on mood.

Rick Emmer
Bay Village, Ohio

Craig Foster responds:

Thank you for your interest. Remember that Phiten's claims rest on microscopic particles of titanium, not titanium generally. It seems safe to assume that the clothesline did not contain any of the so-called Aqua Titanium because Phiten reportedly creates it through a patented process. I doubt that the clothesline contained any non-negligible amounts of titanium, but we did not analyze it.

We did analyze a Phiten necklace. The necklace contained titanium, but we experienced trouble dissolving the necklace's rubber core. This inhibited my confidence in estimating the overall titanium mass weight percentage, so we did not report it. Most importantly, the titanium mass weight percentages do not really matter. The promotion of Aqua Titanium has no credible scientific basis.

We could have omitted our analyses of titanium in the baseball field, but we thought they provided a compelling example of human susceptibility to pseudoscience. The notion that elite baseball players are relying on the power of Aqua Titanium while performing on a big field of titanium is remarkable. Yet, this irony is also understandable. Most people are not familiar with the science surrounding Phiten's claims. Accordingly, they can purchase necklaces for the power of an element that is just below their feet.

GMO Labeling

Matthew Nisbet's column "Don't Fear a Franken Public" (May/June 2016) provides new insight on the conflict over genetically modified food labeling. He reports that the public is less frightened by foods so labeled and is more influenced by price, which is 50 percent the cost of "organic" foods. He notes that Campbell's Soups is voluntarily labeling its soups that contain genetically modified "GM" ingredients and calls for mandatory labeling. Prof. Nisbet also favors mandatory labeling and throughout the article uses the less familiar "GM" label for genetically modified foods rather than the more familiar, but negatively tainted by organic producers, "GMO" label.

Since "GM" or "GMO" is only a very general description of how the food plant or animal is designed and tells the consumer nothing about the quality of product to be consumed, it provides the consumer with no useful information. GMO is a scarecrow created by the organic growers in their struggle against agribusiness. At best, it should be a voluntary label, such as "natural," and neither required nor forbidden. Perhaps those opposed to legislation requiring GMO labeling, besides using GM labeling, might try attaching riders or amendments to such labeling legislation. They might require those labeling their foods organic to state that their foods contain no "inorganic" ingredients. An organic ham could be smoked with natural wood but not be salted, since salt is an "inorganic" element. Or perhaps they might require those labeling their foods "regional" to affirm that the food was grown within thirty-five miles of the point of sale. Or require that plants or animals developed since 1800 be labeled "Modern" and older varieties be labeled "Old Fashioned."

There is no end to the absurdity that labeling could go beyond current labeling with chemicals we have never heard of, let alone able to pronounce!

David W. Briggs
Marion, Massachusetts

Belief, Science, and the Genome

I enjoyed Michael Reynolds's critique "A Testament of Belief Masquerading as Science" of Francis S. Collins's book (May/June 2016). However, I was surprised to learn that Collins is a Nobel laureate. The Nobel website does not list him as a recipient of the prize [Note: he is not, and this mistake by the editor was subject of a correction in the subsequent SI, July/August, p. 65]; but, a web search reveals that Collins might be angling for that honor.

According to Laura Helmuth, who worked for *Science*'s news department when the human genome sequence was first published in 2001, the public consortium headed by Collins tried to prevent their rivals at Celera from publishing in *Science*. Nevertheless, Celera's paper appeared.

In 2003, Collins's team published the "complete" human genome, which hadn't made major changes to the analyses from the original reports. Throughout 2013, the NIH hosted anniversary events and the Smithsonian's Museum of Natural History recently opened an exhibit called "Genome: Unlocking Life's Code." Promotional materials claim that the Genome was sequenced in 2003.

Helmut asked the National Genome Research Institute why it celebrated 2003 as the year of the genome. Their reply: "This is because 2003 marked the final release of the genome sequence, and the research the institute does now is widely based off of it. You're right by saying that the 2001 papers were extremely important and groundbreaking, but 2003 marks the year that the Human Genome Project was completed and the completed genome sequence was released.

Helmut points out that the Nobel Prize cannot be shared by more than three individuals. The actions of the organizations over which Collins heads or holds influence appear to be clearing the way for Collins to take credit for sequencing the human genome. The full article can be accessed on the web at http://tinyurl.com/k4cklwn.

Perhaps Collins will someday get the Prize, but he is not yet a Nobel laureate.

Mark G. Kuzyk
Pullman, Washington

Regarding "A Testament of Belief Masquerading as Science": Science and religion are in conflict; they are opposites. Religion is authority based on belief and faith. Science is the antidote to belief and faith in the journey toward knowledge.

The first-cause argument for a god is but a fancy way to avoid the three words hardest to utter by humans: I don't know. All first-cause arguments suffer from what happened before that. First cause is a definition, not an argument.

Belief and faith are fancy words for basic human wants. We endlessly want there to be a first cause, thus believers accept as true a belief in a god without real evidence. We want so badly for there to be life after death, thus we have faith in heaven, hell, reincarnation, or an afterlife of some sort. Faith and belief "fancify" powerful and universal wants we humans hold.

What believers find difficult to imagine is that all their "evidence" for the existence of a god points equally to a god being created by humans in our image rather than the other way round—which of course is the case.

David Southwick
Enosburg Falls, Vermont

In reading Michael Reynolds's review of Francis S. Collins's book *The Language of God*, I found it interesting that Collins opines that "the concept of right and wrong appears to be universal among all members of the human species." He then equates this Moral Law with something akin to a physical law, such as the law of gravitation. And he goes on to suggest this Moral Law as among the strongest evidence for the existence of God.

I found the juxtaposition of this review with another article in your May/June 2016 issue, "Dissociation and Paranormal Beliefs" by Sharps, Liao, and Herrera rather amusing. The opening sentence of this article reads, "Virtually all known human cultures possess belief in the paranormal." Since belief in the paranormal is universal among cultures, can we also consider it close to a physical law, as Collins's does the Moral Law, perhaps the Law of the Paranormal?! And using Collins's reasoning, can the university of the Law of the Paranormal be further evidence for the existence of God, or does it suggest the opposite?

John McCormick
Chico, California

[FEEDBACK

The letters column is a forum on matters raised in previous issues. **Letters should be no longer than 225 words.** Due to the volume of letters we receive, not all can be published. Send letters as email text (not attachments) to letters@csicop.org. In the subject line, provide your surname and informative identification, e.g.: "Smith Letter on Jones evolution article." Include your name and address at the end of the letter. You may also mail your letter to the editor to 944 Deer Dr. NE, Albuquerque, NM 87122.

There's much more available on our website!
Skeptical Inquirer

Here's just a sample of what you'll find:

The Man Behind the Makeup: An Interview with Captain Disillusion
The indefatigable Susan Gerbic interviews Alan Melikdjanian, creator and star of the humorous Captain Disillusion web series that stars a superhero on a fictional children's show. Gerbic writes that "While the word *debunker* might seem like a negative word, in this case I can't think of a better word for what Melikdjanian does."

Glucosamine and Chondroitin: Do They Really Work?
Frequent Skeptical Inquirer contributor Dr. Harriet Hall, also known as the Skepdoc, takes a closer look at the supplements glucosamine and chondroitin, which are widely used for osteoarthritis pain. She writes (spoiler alert!): "Their popularity is puzzling since the evidence from scientific studies indicates that they don't work."

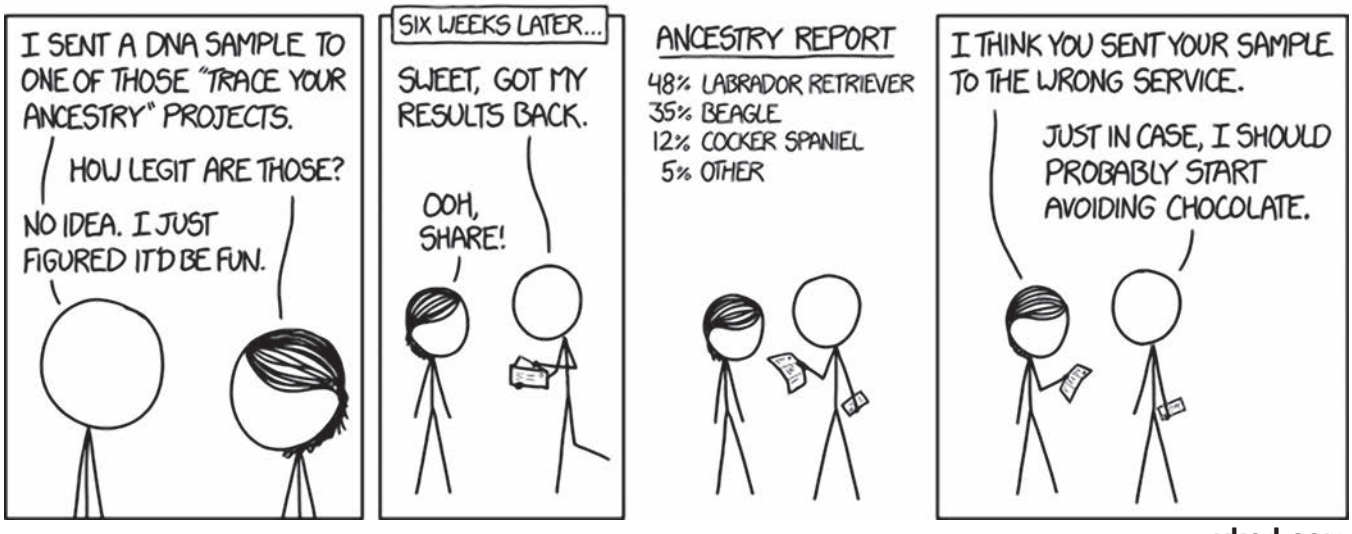
SKEPTICAL ANNIVERSARIES

by Tim Farley

September 1976: The mystery-mongering TV series *In Search Of…* first airs.
September 5, 1996: Holocaust denier David Irving sues Deborah Lipstadt and Penguin Books for libel (and later loses). The case would later be depicted in the 2016 motion picture *Denial*.
September 9, 1991: Doug Bower and Dave Chorley publicly admit to thirteen years of hoaxing crop circles in England, inspiring copycat pranksters along the way.
September 19, 1961: Betty and Barney Hill claim they were abducted by a UFO in New Hampshire.
September 27, 1726: Englishwoman Mary Toft claims to have given birth to baby rabbits in a famous hoax, debunked later that year.
October 3, 1991: Jacques Benveniste and Erich Von Däniken are among the honorees at the first Ig Nobel Prizes (in Chemistry and Literature, respectively).
October 3, 2006: *Skeptoid,* one of the earliest skeptical podcasts, premiers with an episode about "New Age Energy."
October 6, 1961: The American Medical Association and the U.S. Food and Drug Administration jointly convene a National Congress on Quackery in Washington, DC.
October 12, 1976: The lawsuit *Wilk v. American Medical Association*, which charges the physicians organization of conspiring against the chiropractic field, is filed. It is resolved eleven years later in favor of the chiropractors.
October 31, 1926: Famed magician and skeptic Harry Houdini dies. Annual séances by skeptics are held in a (mostly) tongue-in-cheek attempt to contact him on the anniversary of his death.

Tim Farley is the creator of the website whatstheharm.net. and blogs at skeptools.com. He is a past fellow of the James Randi Educational Foundation.

GENETIC TESTING


I SENT A DNA SAMPLE TO ONE OF THOSE "TRACE YOUR ANCESTRY" PROJECTS.
HOW LEGIT ARE THOSE?
NO IDEA. I JUST FIGURED IT'D BE FUN.
SIX WEEKS LATER...
SWEET, GOT MY RESULTS BACK.
OOH, SHARE!
ANCESTRY REPORT
48% LABRADOR RETRIEVER
35% BEAGLE
12% COCKER SPANIEL
5% OTHER
I THINK YOU SENT YOUR SAMPLE TO THE WRONG SERVICE.
JUST IN CASE, I SHOULD PROBABLY START AVOIDING CHOCOLATE.

xkcd.com

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